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ON THE MEDICAL USE

OF

GALVANISATION AND FARADISATION.

BY

JULIUS ALTHAUS, M.D.,

MEMBER OF THE ROYAL COLLEGE OF PHYSICIANS; FELLOW OF THE ROYAL MEDICAL AND
CHIRURGICAL SOCIETY; SENIOR PHYSICIAN TO THE INFIRMARY FOR EPILEPSY AND PARALYSIS.

NEW EDITION.



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So much progress has recently been made in the knowledge of the physiological and therapeutical effects of electricity and galvanism, that it has appeared to me worth while to put the latest results of my experience, as far as they are of practical importance, on record. I am so much the more induced to do so, as, with the advancement of our knowledge of these agents, their substantial value as remedies has become more obvious, and the indications for their use more firmly established.

One of the most important discoveries of late years has been, that the continuous galvanic current, if applied in a certain manner, produces constant physiological effects on the brain, the spinal cord, and the sympathetic system of nerves, while the induced current acts only on the peripheral nerves and muscles, and not on the nervous centres.* This discovery has naturally enlarged the field of therapeutical action of galvanism to a considerable extent, while at the same time the arrangement of the battery current has lately

* *Vide*, A Treatise on Medical Electricity, theoretical and practical ; and its use in the treatment of paralysis, neuralgia, and other diseases. By Julius Althaus, M.D., etc. Second edition, Revised and partly re-written. London, Longmans, Green, and Co. 1870.

been rendered so perfect as to fully meet all the requirements of practice. The beneficial effects of galvanism are therefore no longer confined, as they previously were, to local paralysis, rheumatism, certain forms of neuralgia, etc., but extend to loss of mental energy, paralysis from affections of the brain and spine, progressive muscular atrophy and other similar complaints. Finally it has been shown that a large field for the action of galvanism is opened up in the treatment of a number of surgical diseases where no other operative proceedings are applicable, or where the patient's dread of the knife is such as to induce him to bear the disease rather than seek the remedy. Thus, for many forms of tumours, the electrolytic treatment has been shown to be superior to the knife, not only by completely avoiding the risk to life which must always attend cutting operations, but also as far as its ultimate curative results are concerned.

Before proceeding to the narration of illustrative cases, I will say a few words on the absolute necessity of an intimate acquaintance with the physiological effects of the various forms of electricity and galvanism for those practitioners who intend to employ these agents in the treatment of disease. With this remedy, more than with any other, the mode of application has an all-important bearing upon the results, as with an improper selection of current, and a faulty mode of administration, the effect produced may be quite contrary to that which is desired. Not only has every organ in the body a different sensibility to the electric current, but we are able, by merely varying the mode of application, to arouse, or to exhaust the energy of organs, and to diminish or to increase their properties. Indeed, the effects produced are entirely different according to the form of electricity that is used, the quantity and intensity employed, the mode in which it is transmitted to the human body, and the length of time during which its action is kept up.

It should also be borne in mind that this powerful agent is not one of those remedies which, if they do no good, can do no harm; but, on the contrary, it may, in the hands of an inexperienced operator, do a great deal of mischief. A galvanic treatment can therefore only be safe and successful where the operator is guided by physiological knowledge, an intimate acquaintance with the results of pathological research, and a sufficient amount of therapeutical experience.

I now proceed to illustrate the therapeutical value of Galvanisation and Faradisation by a short series of cases which have been under my care in private and hospital practice.

Loss of Mental Energy from Imperfect Cerebral Nutrition.

Cases frequently occur which cannot be classified either as paralysis, or insanity, or any other definite disease of the nervous system; but the symptoms of which are evidently due to impaired nutrition of the grey matter of the brain, and which, if unchecked in their progress, would in course of time undoubtedly merge either into paralysis, or insanity, or both. In such cases Galvanisation of the nervous centres appears to be one of the most rational modes of treatment.

CASE I.—A merchant, aged 48, widower, consulted me in March, 1867, for nervousness and irritability of temper. He had for some years past experienced considerable anxiety in business, to which he attributed his illness. He complained of a sensation of weight and pressure at the top of the head and in the temples, and of dizziness chiefly on stooping and looking upwards. His memory and power of application were very much impaired. The speech was somewhat affected, so that the patient would stop in the middle of a sentence, hesitate for a few seconds, and then abruptly finish it. Whenever anything unexpected or disagreeable occurred, he became very much flushed in the face, had sensations of tingling resembling slight electric shocks running down his hands, and would for the time completely lose the faculty of speech. The right pupil was larger than the left, and the sight was often dim. The temperature of the right,

cheek was 88° and that of the left 87° F. The right ear was also hotter than the left. The pulse was sometimes intermittent and irregular, and the patient complained of palpitations of the heart and shortness of breath in walking, more especially on going upstairs, but there was no disease of the heart or lungs in this case. The tongue was dry and thickly coated, the appetite indifferent, and a sense of fulness and heaviness was experienced after meals. The action of the bowels was irregular. The urine contained an enormous excess of phosphates, but not of urea, and the expulsive power of the bladder was diminished. The patient had become very stout during the last few years, and his muscles were extremely flabby. He rarely took active exercise, as it seemed to make him worse. He had already taken iron and quinine, strychnia, belladonna, and bromide of potassium, but without any improvement. For the last eighteen months he had felt too feeble to attend to his business.

In this case Galvanisation of the spine, the cerebral hemispheres, and the sympathetic, was resorted to with satisfactory results. Almost all the morbid symptoms gradually yielded to it, and ten weeks after the commencement of the treatment the patient was enabled to return to his business. He found that he could work well for about a couple of hours at a time, but that when he went beyond that, the symptoms of pressure on the head and tingling in the arms were apt to return.

The patient had another but much shorter course of Galvanisation in November 1867, and again in June, 1868, when several of the old symptoms had reappeared. On both these occasions they yielded rapidly to the influence of the continuous current; and when I saw the patient last (May, 1869) he was, although not strong, yet in good health, and had been enabled, by restricting his hours of work, to attend to his business without any interruption.

Dipsomania and Excessive Spirit Drinking.

I am strongly inclined to believe that a systematic use of the continuous current would prove of much service in dipsomania. Up to the present time I have only treated one case of this affection, with good results; although the time elapsed since the patient was discharged (sixteen months) is not sufficient to know whether the effect has been permanent. But I have seen a considerable number of cases in which mental depression and nervousness were so great that the patients had long been in the habit of taking large quantities

of stimulants, in order to deaden the acuteness of their wretched sensations ; and where the morbid desire for alcohol was rapidly checked as soon as they were fairly brought under the influence of the continuous current, applied in an ascending direction to the spine, the cerebrum, and the cervical sympathetic. One of these cases is the following :—

CASE II.—In June, 1868, a lawyer, aged 37, married, came under my care, who had, in consequence of overwork and anxiety, got into a state of complete nervous derangement. He was utterly incapable of any mental or bodily exertion before he had taken three or four ounces of brandy (in the morning), and was in the habit of consuming rather more than a pint of spirit every day. He hated the very sight and smell of brandy but if he did not take it, such horrible thoughts came into his head as to render life perfectly intolerable. His judgment and intellect were not impaired, but he had not the slightest control over the dreadful ideas which constantly flitted across his brain if not under the influence of alcohol, and which were chiefly of a homicidal and suicidal character. Tonics of every kind made him worse, and several alteratives of considerable efficacy (such as bromide of potassium and bichloride of mercury) had apparently increased his debility to such an extent as to render a prolonged course of them impracticable. Under these circumstances, the application of the continuous current to the nervous centres seemed expedient. Within a week from the commencement of the treatment, the patient was able to discontinue the brandy in the morning. After three months he had come down to half a pint of sherry for dinner, and took no spirits whatever. His mental and bodily health improved *pari passu*, and when I saw him again in March, 1869, he appeared perfectly well, and had lost every symptom of his previous illness. In this case the galvanism was applied forty-five times. No medicine was given.

Paralysis.

While only little evidence exists up to the present time concerning the beneficial effects of galvanism in disorders of the mind, a very extensive experience has already been accumulated on its use in paralytic conditions, where, in the absence of other remedies having a direct curative influence on the paralysis, electricity finds a most legitimate and useful sphere of action.

Cerebral Paralysis.

The most frequent form of cerebral paralysis is hemiplegia, which is caused either by the rupture of blood-vessels and subsequent hæmorrhage into one of the cerebral hemispheres; or by laceration of the tissue of the thalamus opticus and corpus striatum, in consequence of softening; or by embolism of an important cerebral artery. Such pathological processes impede the conduction of the orders of volition, which, in the normal state of the brain, are carried through the fibres of the corpora pyramidalia to the motor nerves of the opposite side of the body, to the muscles, so that these become incapable of executing voluntary movements.

If the patient survives the paralytic stroke, a process of reparation soon afterwards commences in the cerebral substance, which is more or less thorough according to the degree of the paralysing lesion. Where an extensive laceration of cerebral tissue has taken place, the paralysis will, in all probability, remain permanent; but where there has been merely an effusion of a small quantity of blood, the symptoms are rather caused by the clot pressing upon the brain-matter than by destruction of cerebral tissue; and in such cases the patient's health may be perfectly restored. At first the fluid parts of the blood which has been effused are absorbed, and an organised membrane, a cyst, is formed round the clot, which in course of time is likewise absorbed. The cyst then shrinks up, and at last only a cicatrix is found. In a certain number of cases this process of reparation is accompanied by a gradual amelioration of the paralytic symptoms, and thus spontaneous recovery may take place. In other instances the gradual shrinking of the cyst acts as an irritant on the brain, when the paralysed muscles assume a rigid condition, and the motor nerves appear to undergo various morbid alterations. Finally, the cicatrix may have

been formed, and there may be no rigidity of the muscles, but the paralysis still continues in a more or less degree, owing to the function of the injured hemisphere remaining in abeyance, in consequence of hyperæmia, serous effusion, or the effects of shock.

It is doubtful whether the process of reparation itself and the formation of the cyst may be promoted or accelerated by the use of galvanism; but it seems certain that by cerebral Galvanisation the parts in the neighbourhood of the paralyzing lesion, which have become unable to fulfil their function, through hyperæmia, serous effusion, or shock, may, by the galvanic stimulus, be enabled to regain their function.

In the large majority of cases, cerebral Galvanisation alone is not sufficient to produce decidedly beneficial effects; and peripheral Galvanisation or Faradisation must be combined with it. In such cases the paralysis is no longer exclusively due to the injury of the affected hemisphere, but more to the loss of vital energy of the nerves and muscles of the affected limbs, the molecules of which seem to have lost that mobility which otherwise enables them to respond to the orders of volition. Whether in such cases Galvanisation or Faradisation should be resorted to, will depend upon the individual aspect of the case under treatment; and it may be laid down as a general rule, that where the electro-muscular excitability is normal, Galvanisation, and where it is diminished, Faradisation should be employed.

The following is a case in which only a few muscles remained paralysed after the stroke, and in which a considerable amelioration was produced by Faradisation.

CASE III.—Jane S., aged 35, was, in July, 1857, admitted into Carlisle ward, St. Mary's Hospital, under the care of Dr. Alderson. From the somewhat confused statement of the patient, whose intellect and memory are below the average, it appears that she had an apoplectic seizure fifteen months ago, in which she lost consciousness and the use

of the left arm and leg. The leg appears to have soon recovered ; at least, when I first saw her, on July 20, she could walk with ease, but several muscles of the left arm were paralysed, viz., the deltoid, the extensor of the fore-finger, and all the muscles of the thumb. She could raise the humerus, this movement being produced by the concurrent action of the trapezius, serratus magnus, and deltoid, but she was not able to lift the arm to a right angle with her body, and when she held the hand on the lower part of the spine, she could not move it upwards. The forefinger was slightly contracted, and could not be extended ; the thumb was held against the forefinger, and was totally powerless. All the affected muscles were flabby and wasted. The patient was not able to use her needle or do any other work. When I directed the faradic current to the paralysed muscles, they showed much less excitability to it than the corresponding muscles of the other side. The deltoid was much improved after five applications ; but the muscles of the forefinger and thumb recovered only after a month's treatment, in which Faradisation was used about twenty times. The patient then left the hospital, being again able to use her needle, and to accept a situation as cook.

The following is another case of this description, in which the loss of power was more general :—

CASE IV.—B. W., a gentleman aged 68, of gouty constitution, first came under my care in June, 1866. He was then suffering a good deal from gravel, and excess of uric acid in the urine, and digestion and assimilation had been imperfect for five or six years. In December 1866, while dressing for dinner, he had an apoplectic seizure, accompanied with loss of consciousness and paralysis of the left side of the body. For a week he was in a very precarious condition, and I believe his life was only saved by large doses of ammonia and chloric ether which I ordered to be given at short intervals. He gradually, however recovered his consciousness and intellect ; the face resumed its normal appearance, and the muscles of the arm also improved. Four months after the attack he was in the following condition :—His memory and speech were unaffected, and there were no distressing sensations in the head. The skin of the left arm and leg was cold and flabby, and the pulse weaker in the left than in the right side. There was a feeling of numbness, and a certain degree of anæsthesia, in the left arm and leg. The muscles were relaxed and somewhat wasted, especially the extensors, but there was no rigidity either in the upper or in the lower extremity. Feeding, dressing, and all other movements of the arm and hand were extremely difficult, although with a great amount of exertion they could be performed. The patient could walk comfort-

ably for half a mile, but then began to feel fatigued, and was obliged to rest.

From these symptoms I concluded that the clot which had been formed in the right corpus striatum and thalamus opticus, and which had produced the paralysis, had, to a great extent, been absorbed. If, therefore, the original injury had been repaired, the seat of the paralysis was now not so much in the brain as in the motor nerves and muscles, which had been weakened by their long disuse. Faradisation was therefore now resorted to, with the result that, after sixteen applications, the bulk of the muscles was increased, the circulation in the limbs was properly re-established, and the patient had almost entirely recovered his motive power.

In a certain number of cases of hemiplegia the nerves and muscles of the affected side are as equally excitable to electricity as those of the healthy side. In these cases the continuous current is more valuable than Faradisation.

CASE V.—A naval officer, aged 54, unmarried, came under my care in February, 1868. He had had an apoplectic seizure in June, 1866, in which he lost the use of the left side. Speech and consciousness had not been impaired, but the arm and leg had been completely paralysed for about three months. Both extremities then began to recover their motive power to some extent; but as they were still very weak about twelve months after the stroke, the patient was faradised in the country, with satisfactory results. The leg became much stronger, so that he was soon enabled to walk without a stick, for two or three miles at a time. The arm also improved, but not nearly as much as the leg, and the treatment was discontinued after three months, as it did not seem to produce any further effect. The patient then came to town to consult me, and as Faradisation had already had a fair trial, I used Galvanisation of the right cerebral hemisphere, and of the motor nerves and muscles of the arm. Within three weeks the patient had so far recovered the use of the hand as to be able to do everything for himself, although it was not yet quite as strong as the right hand.

There are few cases of hemiplegia where there is not a slight amount of rigidity in some of the paralysed muscles; but in some instances the rigidity is so severe as to form the most prominent symptom. Twitchings of the fingers and toes are often connected with it; they occur especially at

night, and seriously interfere with sleep. In such cases, likewise, the continuous current should be used in preference to Faradisation.

In cases of this kind, Galvanisation of the injured hemisphere attacks the seat of the disease, and if not able to restore any destroyed brain-matter to its previous healthy condition, yet does good in this way, that it not only seems to check the inflammatory irritation, and to promote the absorption of effusions which have taken place, but also restores energy to the neighbouring parts of brain-tissue which have not been destroyed as far as their texture is concerned, but merely deprived of their vital force, either by the pressure of the effusion, or by the shock experienced during the apoplectic attack. The presence of early muscular rigidity is therefore no longer a thoroughly bad symptom in these cases; but if, in addition to the rigidity, spasms and convulsions are present in the paralysed side, the prognosis is, generally speaking, more unfavourable.

The results of Galvanisation are not always very quick in such cases; yet it is satisfactory to see how, even in the apparently worst cases of hemiplegia with rigidity, perseverance in treatment is rewarded by success. Private patients are apt to lose hope if there is not a rapid improvement; but from what I have seen in the out-patients of hospital practice, where I have been able to keep such cases under observation for many months consecutively, I have come to the conclusion that no case, however bad, is utterly hopeless.

Where paralysis is owing to tumour or abscess of the brain, or any other severe structural lesion, no form of electricity can do good. But where it seems to occur in consequence of exhaustion and serous effusion, the continuous current is the best remedy. The effect is generally immediate, and almost magical. The following case is one of this class :—

CASE VI.—*Paralysis of the right arm in consequence of sudden loss of cerebral energy.*

A merchant, aged 52, married, had been in a low state of health for some years past, in consequence of much anxiety and trouble, but had not suffered from any serious illness. He was sitting quietly at home, on July 20, 1867, writing a letter, when he suddenly felt faint and giddy, the pen dropped out of his hand, and he completely lost the use of the right arm. He did not lose his speech and consciousness, nor the use of the leg, nor was the face distorted. A friend who happened to be present advised him to put his hand into boiling water, which he did, and blistered it most severely with it. (The same barbarous treatment, which, of course, cannot do the least good, has been adopted in at least a dozen cases of paralysis which have been under my care.) As the scalding of the arm and hand produced no effect, a cold douche was next applied to it, and the wrist was then a good deal knocked about, in order to get the life back into it. As none of these violent measures had any effect, the patient consulted me two days afterwards, when I found complete paralysis of the forearm and hand, and nearly complete anæsthesia of the hand and fingers. I applied a current of twenty cells to the left hemisphere for one minute, after which the patient lifted his wrist and moved the fingers to a slight extent. I did not use any peripheral Galvanisation. Two days afterwards he came again, when I found that the improvement had continued, but not made further progress. I then again resorted to cerebral Galvanisation, with the effect that a little more action in the hand became manifest. But, as it was still very weak, I now combined peripheral Galvanisation of the radial and median nerve with it. The effect of this was apparently even greater than that of the cerebral application, as the patient could grasp my hand firmly afterwards, and dress himself without assistance. Another application of galvanism on the following day completely restored the use of the hand and fingers.

Concerning the pathology of this case I would remark that evidently no rupture of a blood-vessel could have taken place in the left hemisphere, as then the effects of the continuous current, applied so shortly after the seizure, would not have been so great. The paralysis probably arose from exhaustion of that portion of the brain which is the centre for the motor nerves of the upper extremity, and was accompanied with slight serous effusion.

Most cases of paralysis which occur during convalescence from acute diseases have the same pathology as the case just described, and should therefore be treated by the same means. In these conditions the induced current is not nearly as useful as the continuous, because its effects are only peripheral, and the disease is of central origin. Cases of this kind occur after measles, scarlet fever, small pox, erysipelas, typhoid fever, pneumonia, dysentery, cholera, and puerperal fever. Diphtheritic paralysis has a somewhat different pathology, as it is due partly to the local effects of the poison on the pharynx, and partly to its general effects on the blood. In all these affections, Galvanisation and Faradisation are the best remedies at our disposal.

Spinal Paralysis.

Whether galvanisation is likely to do good or not in spinal paralysis, depends chiefly upon the cause and duration of the disease, and upon the age and constitution of the patient.

Cæteris paribus, young patients and recent cases are more likely to get well than the reverse.

CASE VII.—A commercial traveller, aged 38, consulted me in October, 1864, for weakness in the back, and loss of power in the lower extremities. He began to suffer in March of the same year, after unusually hard work and great fatigues; and had got gradually worse from that time. At first he felt a sensation of pins and needles in the feet, but this had now been succeeded by numbness. His gait was tottering, and he could only walk by the aid of two sticks. There was a high degree of anæsthesia in the back from the sixth dorsal vertebra downwards, and also in both thighs and legs, so that the application of an extremely powerful galvanic current was only just felt as a slight tingling sensation. The patient also suffered from costiveness and difficulty of micturition. There was no ataxy. I applied the continuous current twice a week for two months, at the end of which time the patient could walk without a stick, had lost the feeling of numbness in the feet, and the anæsthesia of the back

had so far yielded that the application of forty cells of the battery was all he could comfortably bear, while at first the current of a hundred cells had appeared to him 'like nothing.' From beginning with the latter number, I gradually came down to fifteen cells, which were distinctly felt when I discontinued the galvanism. The patient being anxious to resume his avocations, I put him on a course of nitrate of silver, in order to guard him against a relapse ; and I lately heard that he had remained in good working condition ever since.

Hysterical Paralysis.

This form of paralysis, which occurs almost exclusively after mental shock and emotion, in girls and women whose sensibility is unusually acute, may attack a few muscles only, or an entire limb, or the whole body. It frequently assumes the form of paraplegia, but hysterical hemiplegia is by no means uncommon. Hysterical paralysis is altogether a functional disorder, and in no way connected with structural lesions in the nervous centres, the peripheral nerves or the muscles. Many of these cases may be cured by Galvanisation or Faradisation, whilst some are extremely stubborn.

CASE VIII.—A girl, aged 19, living at Kilburn, became an out-patient at the Samaritan Free Hospital in September, 1864, and was sent to me by Dr. Savage. She had always been in indifferent health, and during the last three years had gradually lost the power over her arms and legs, to such an extent that she was scarcely able to walk even when supported, and entirely incapacitated from doing any work whatever. The cause of the affection was said to be due to "some trouble" she had had. She first menstruated at 15 years of age, but was always irregular the discharge being very pale and scanty. Sixteen months ago the catamenia ceased altogether, and from that time she became nearly idiotic. She was very listless when I first saw her, had a vacant look, and considerable dilatation of both pupils, more especially of the left one. The left iris was scarcely at all influenced even by strong light. The voice was almost entirely gone ; she could only speak in a faint whisper. She was frequently troubled by pain in the head and the back. Her hands and feet were always quite cold. She complained of sickness in the morning, total want of appetite, and constipated bowels. She was always worse after emotions, and had frequently had hysterical fits. The muscles were very badly nourished, but contracted tolerably well under the influence of the electro-mag-

netic current. Besides there was nearly complete anæsthesia of the whole left side, including the conjunctiva. On the right side the loss of sensation was not so much marked as on the left ; but the prick of a pin was only felt as if it were a touch by some blunt instrument. I applied a continuous current of from 40 to 50 cells to the spine twice a week. After six weeks the patient was so much improved that she could walk three miles at a time without support ; she could dress and feed herself ; was able to do heavy work about the house, and had always warm hands and feet. The voice had returned, the bowels acted regularly, and she was cheerful, and took an interest in everything relating to her affairs. The pupils also gradually recovered their normal size ; and the catamenia re-appeared on the 27th of December, and continued from that time at regular intervals. The patient has several times called upon me within the last two or three years, and informed me that she has continued in perfect health ever since.

CASE IX.—A lady, aged 30, unmarried, was said to have suffered from congestion of the spine eighteen months before she came under my care (May 1868). She had not been able to move from her bed or sofa since then, and had lost flesh to a great extent. When she endeavoured to sit up or walk, she felt so sick that she was obliged to lie down again. There was a sensation of numbness in both lower extremities, and in the back from the sixth dorsal vertebra downwards, but no complete anæsthesia. Both legs were habitually cold ; the appetite was excellent, but the bowels habitually confined, and the catamenia rather too abundant. The cause of the affection was a series of great mental emotions the patient had undergone. Faradisation and Galvanisation were alternately used with the effect that after six weeks' treatment she could walk half-a-mile without feeling sick or tired. The treatment was continued in the country, and when I last heard of her (April 1869) she was again quite strong and well.

Lead Palsy.

In this disease, which affects chiefly painters and compositors, but may also be caused by drinking water, beer or wine, which has been impregnated with lead, or by taking snuff which has been packed in lead-foil, or by the use of cosmetics containing lead, the internal administration of iodide of potassium is necessary for removing the lead from the system ; but this alone is seldom sufficient for curing the disease, the most frequent symptoms of which are

dropping of the wrists, colicky pains in the abdomen, obstinate constipation and weakness, or even loss of sight.

For these symptoms Galvanisation of the optic, sympathetic, and the cord, and Faradisation of the paralysed muscles, is the best treatment.

Paralysis from Disease of the Urinary Organs.

Inflammation and abscess of the kidneys, renal calculus, inflammation of the mucous membrane of the bladder, chronic inflammation and enlargement of the prostate, stricture of the urethra, and other diseases of these parts, may produce incomplete paralysis of the lower extremities. In most of these cases a constitutional treatment is absolutely necessary for the cure of the affection, since the mere application of galvanism to the paralysed limbs cannot remove the cause of the disorder. In some cases, the paralysis disappears after the cause has been removed, but if it still persists after that, a faradic treatment is generally required. In some such patients, Faradisation may even remove the cause, and thus cure the disorder, as is well shown by the following :—

CASE X.—A gentleman, aged 36, consulted me in December, 1866, for general debility and want of power in walking. He was not actually paralysed, but very weak in his legs, which was partly due to malnutrition of the muscles, and partly to pain in the thighs, which increased on walking. This pain seemed to radiate from the perinæum, and was increased on emptying the bladder and on taking exercise. As the perinæum was very tender to touch, I made a rectal examination of the prostate, and discovered that that organ was very sensitive, and considerably enlarged. The patient then told me that he had had gonorrhœal inflammation in 1862, and again in 1865, which was evidently the cause of the chronic inflammation of the prostate. The urine was neutral, and contained a good deal of muco-pus. The patient had already taken iodide of potassium, iron, and strychnia, without benefit. I prescribed small doses of liquor arsenicalis for improving the secretion of the urine, and applied Faradisation to the prostate, for reducing the enlargement. The first application gave

relief, as the tenderness in the perinæum was diminished, and the patient could walk with more ease afterwards; nor was micturition so painful as it had been before. The urine was slightly acid after the arsenic had been taken for five days, and in about a fortnight it was perfectly healthy. After twenty-one faradic applications, the size of the prostate had become normal, with proportionate improvement in all the symptoms. The muscles of the thighs and legs were now galvanised several times, and within six weeks the patient was quite recovered.

Rheumatic Paralysis.

Paralysis of certain muscles or sets of muscles is not unfrequently induced by rheumatism. The angler, the huntsman, and others who by pleasure or necessity are much exposed to damp and cold, are chiefly liable to this kind of palsy, which affects with preference the muscles of the lower extremities, thus giving rise to incomplete paraplegia, which is frequently mistaken for a symptom of disease of the spinal cord.

There is no kind of paralysis in which the therapeutical effects of Faradisation are so striking as in rheumatic paralysis, in which affection it cannot be replaced by any purely medicinal treatment. This applies also to protracted and severe cases which have resisted a variety of energetic therapeutical measures. In cases of muscular atrophy resulting from rheumatic paralysis, Faradisation is likewise of great service.

CASE XI.—*Rheumatic Paralysis of the Forearm and Hand.*

Mrs. G. aged 51, was sent to me by Dr. Hyde Salter, in January, 1862. Three months before she had suffered from a severe attack of rheumatic fever, nearly all the joints having been affected. As soon as she was able to move about again, she went into the country, where her general health much improved. Her right arm and hand, however, remained painful and useless, and she was therefore advised to try Faradisation. On examining the fore-arm and the hand with the æsthesiometer, I found that the sense of touch was considerably impaired. The muscles were wasted, more especially the flexors and the interossei and lumbricals; and on applying the faradic current to

these muscles individually, it appeared that their sensibility, as well as their contractile power, were very nearly gone. The hand had lost its natural shape, and resembled a bird's claw; a configuration of the hand which is always associated with loss of power in the interossei and lumbrical muscles, and renders it entirely useless. The pain was greatest at night, and chiefly felt in the fingers. The general health of the patient was tolerably good, but she was very thin, and suffered greatly from despondency. I used Faradisation of the skin for the cure of the pain, and of the suffering muscles for restoring them to their normal nutrition and function. After two operations the motor power of the fingers was much increased; the muscles responded more readily to the faradic stimulus, and the æsthesiometer showed an improvement in the sense of touch. The pain, although not entirely gone, was much diminished. After a fortnight's treatment, the patient attending every other day, she was able to cut her own meat, and to do some housework, and in a month she could do needlework for three hours consecutively without feeling pain or fatigue. There was then no longer any difference in the sense of touch in the right and left arm, the bulk of the muscles was much increased, and the hand had resumed its normal shape. This result was all the more satisfactory, as the age and general weakness of the patient were not in favour of a rapid cure.

In these cases Galvanisation is equally effective as Faradisation, and sometimes even more rapid in its action.

Reflex Paralysis.

This form of paralysis, which is due to an irritation proceeding from a sensitive nerve, and thence transmitted to the spinal cord, often disappears spontaneously as soon as the irritation is removed; in many cases however, even after the cessation of the cause, the paralysis remains; and then Faradisation or Galvanisation are by far the best therapeutical measures to be used. Again, in many cases, Faradisation or Galvanisation may remove the irritation, and thus exercise a curative action. These propositions will be best understood, if illustrated by a few cases.

CASE XII.—*Reflex Paralysis of the Hand after Amputation of a Finger.*

Mrs. D., aged 42, pricked the forefinger of her left hand, with a

needle. This induced considerable pain, of which she did not at first take much notice; but as the finger soon became much inflamed, she applied for medical advice. Notwithstanding the treatment she underwent, the inflammation increased, gangrene ensued, and at last amputation of the finger became necessary. This operation was performed by Mr. Spencer Wells, on December 23, 1858. Three months elapsed before the stump was healed, as at first the pus was of a very bad character; and the secretion only improved after repeated cauterisations with nitrate of silver. When the cicatrix had at last been formed, it appeared that the patient had entirely lost the use of her hand, and Mr. Wells then sent her to me. When I first saw her the fingers were extended and quite stiff; flexion and lateral movements were impossible. The forearm could only with difficulty be bent, and every movement of it was painful. Numbness was felt in all the fingers, and pain in the elbow was complained of. The stump, which had a livid colour, was extremely sensitive, and at the slightest touch of it the patient almost fainted. Besides this, she had that peculiar symptom which is by no means rare in persons who have undergone an amputation; that is, she felt pain in the removed part, which increased towards evening. Otherwise she was in fair health, with the exception, however, that she had three years before, after a difficult labour, lost the catamenia, and, in consequence of this, she suffered from headache for a few days every month. I directed a primary faradic current to the left arm, the positive pole being alternately applied to the trunks of the median and ulnar nerves. Intra-muscular Faradisation of the interossei and lumbricals was also performed. Immediately after the first application, the patient was able to bend the second and third phalanges of the fingers; and after three more applications, she was no longer troubled with pain in the removed finger. After the ninth operation the catamenia reappeared. The restoration of the mobility of the first phalanges of the fingers required a somewhat longer treatment, as in them the affection was very obstinate; but after some weeks this was also attained. At the same time the stump had assumed a much healthier colour; it was firmer, and not so sensitive to touch as before. The catamenia continued afterwards at regular intervals.

CASE XIII.—*Reflex Paralysis and Neuralgia of the Forearm after Fracture.*

M. W., a married woman, aged 46, suffered a fracture of the lower end of the radius of the right arm, in consequence of a fall. She became an out-patient at the Middlesex Hospital, where a bandage was applied; but, by the carelessness of the patient, this got out of

order, and the bone healed crookedly in consequence. It was then again fractured by a surgeon, and put straight; but the cure was now protracted over ten months; and when the bone was at last healed, the arm remained painful and entirely useless. She became, some time afterwards, an out-patient of the Samaritan Free Hospital, and was sent to me by Dr. Henry G. Wright. Faradisation of the Median and ulnar nerves was twice performed, when the pain was entirely gone, and the arm could be used as before.

CASE XIV.—A gentleman, aged 46, when on a shooting excursion, in October, 1867, accidentally shot the thumb of his right hand off at the metacarpal joint. The wound took nearly six weeks to heal, and it was then found that the hand was completely paralysed. Strychnia and stimulating embrocations were used, but without any effect; and the hand was totally useless when the patient consulted me in April, 1868. One application of the continuous current restored the mobility of the hand; but as it was still weaker than the left hand, the current was applied three times more, after which the hand was as useful as it could be minus a thumb.

CASE XV.—A young lady, aged 15, of scrofulous habits, suffered from an abscess on the right side of the neck which had to be opened, and was rather slow to heal. When the wound was quite closed, it was found that there was complete loss of power in the left trapezius and other muscles which execute the lateral movement of the head, so that the patient was unable to turn the head to the left side, while she could turn it to the right. I was consulted some time afterwards (July 1869), and applied the continuous current intermittently to the suffering muscles. After the current had acted for about ten seconds, I desired the patient to make an effort to move her head to the left, when it was found that she could do it, although not easily. A few more applications completely restored the power in the muscles which had been paralysed.

Peripheral Paralysis from Injury to the Nerves.

This occurs chiefly in consequence of accidents to the nerves, whereby they are torn or otherwise divided.

Whether the regeneration of the nerve, and therefore the re-establishment of its conductivity, may be promoted or accelerated by the use of any form of electricity, is as yet unknown. It is, however, certain that when the regeneration of the nerve has taken place, and this does nevertheless

not regain its functions, electricity is the most effective means to restore its obedience to the orders of volition.

CASE XVI.—An unmarried lady, aged 30, of delicate constitution and sedentary habits, was sent to me by Dr. Thorowgood in June, 1868. She had had a railway accident, near Basle, in Switzerland, in September, 1867, when the carriage in which she was seated fell down a steep bank, and was upset. She was stunned for a time, but soon recovered herself. Her right collar-bone, however, was broken, and the skin and subjacent parts on the lower half of the right forearm were severely lacerated. For a fortnight after the accident, she felt (pins and needles) in her arms and legs, but had not done so lately. The fracture of the collar-bone healed within two months, and the injury to the soft parts of the forearm likewise. Three deep scars are to be seen on the front of the latter. There were all the symptoms of certain branches of the nerves of the arm having considerably suffered. Cutaneous sensibility in the lower part of the forearm, the hand, and the fingers was considerably diminished; the third finger being the worst in this respect. Concerning the sense of touch, it was found that the two points of the æsthesiometer were felt at the proper distance in the first, second, and little finger, but not in the third, where only one point was felt. Electro-cutaneous sensibility, both from Faradisation and Galvanisation, was likewise impaired, more especially in the third finger. The interossei and lumbrical muscles of the right hand were weak and wasted; the intra-metacarpal spaces being hollow, and the bones protruding. Farado-muscular contractility was much diminished, but nowhere completely lost; galvano-muscular contractility was somewhat increased. The patient experienced much difficulty in carving, dressing, writing, and buttoning her sleeves and gloves; but she could do all these things with an effort. She was able to bend the first phalanges, but not the second and third. There was no difference of temperature in the two hands. The lower portion of the forearm was emaciated, there being a difference of seven-eighths of an inch between the two arms; for, while the left arm measured fully seven inches, the right measured only six and one-eighth. The general health of the patient was satisfactory. I applied the positive pole of twenty cells to the cicatrices, in order to promote, if possible, the regeneration of nervous fibres; and also acted intermittently on the suffering muscles. After four such applications the patient felt a good deal stronger in the arm and wrist; she could hold things better, did not feel so stiff in writing, and her hand and arm did not ache after writing as they used to do. She also found carving and dressing easier, and had succeeded in turning a key in a lock, which she could not do

before. After a few more applications, the third finger, which had formerly appeared as a "dead log," recovered its sensibility, and she felt the prick of a pin and the two points of the compasses quite distinctly. The metacarpal spaces became more filled up, and when she left town for change of air, a month after the commencement of the treatment, the arm and hand were much more useful than before, although not quite recovered.

Paralysis from Pressure on Nervous Plexuses.

Cases of loss of power from continued pressure, especially from the head resting on the arm, which occurs frequently during intoxication by alcohol, or in patients who are under the influence of chloroform, are generally curable by Faradisation.

CASE XVII.—A lady, aged 23, had her first confinement in November 1864, during which she was for some time under the influence of chloroform. While in this condition her head rested heavily on the left arm, and pressed so much on the brachial plexus that a number of muscles, animated by the latter, became completely paralysed, there being also anæsthesia of the left arm. She was sent to me in January, 1865, by Mr. Paget. The affection was most severe in the muscles of the forearm, the patient being quite unable to lift the wrist, which was much swollen and had to be bound up with a splint. As she also complained of great weakness in the other limbs and the back, I combined a cord-current of fifty cells with Faradisation of the left shoulder and arm. After six weeks of this treatment, the patient had entirely recovered the use of the left hand, and felt very much stronger generally.

Infantile Paralysis.

Infantile paralysis comes on frequently after convulsive fits, owing to irritation of the brain; but sometimes it appears suddenly, without any premonitory symptoms, in a child which is otherwise perfectly healthy. It resists all medicinal treatment, and only very slowly yields to Galvanisation and Faradisation.

CASE XVIII.—A boy, aged 11, came under my care in August, 1867. He was the eldest of three brothers, all of whom had suffered of nervous affections. This boy, when six months old, began to have convulsive fits, and was sometimes screaming the whole night. After an unusually bad attack the right leg became paralysed, the little

patient being then eleven months of age. He had subsequently whooping-cough and scarlet-fever, and had lost his hearing on the right side after the latter complaint. His general health was now tolerably good; the intellect keen, the appetite good, the bowels regular; he had not suffered from convulsions for the last five years. The right thigh measured eight inches and the left twelve, four inches above the patella; the right leg seven inches and the left nine and a half, three inches below the patella. The paralysed leg was about half-an-inch shorter than the healthy one, and he therefore wore a raised boot to correct the difference. The left leg was 2° Fahr. colder than the right, but there was no anæsthesia. Galvano-muscular and farado-muscular excitability were both considerably diminished. I advised the parents to let the boy have a course of Faradisation and Galvanisation occasionally for a month; when no electricity was used, friction of the leg with linim. camph. co., a liberal diet, plenty of fresh air and exercise, and $\frac{1}{40}$ gr. of phosphorus twice a day. The boy has been brought to me three times, and each time improved considerably. When I saw him last, in December, 1868, the difference between the left and right thigh, which was at first four inches, was only one and a half, and the difference between the right and left leg, which was at first two and a half inches, was only one inch. The boy could walk for three or four miles with a stick, without feeling much fatigue, but going upstairs, running and jumping were difficult, and tired him considerably. It is possible that within another year or two, this boy may completely recover.

Palsies of the Muscles of the Eye.

These palsies may be caused by cerebral affections; but are more frequently owing to rheumatic or syphilitic effusions, or to over-exertion of the eyes, or to pressure by tumours and exostoses. The patients are generally treated with iodide of potassium, and counter-irritation of the skin in the neighbourhood of the eye; and some recover by that treatment. Operative interference has often been attempted, but generally left the patient in a worse condition than he was before the operation. Where the usual means do not improve the condition of the paralysed muscles, both Faradisation and Galvanisation may be usefully employed.

CASE XIX.—A lady, aged 43, who had been in the habit of over-exerting her eyes, being very fond of painting in water-colours, was exposed

to wet and cold in November, 1861, and suddenly noticed that she saw everything double. A blister was applied behind the ear, and she was freely purged, after which she was put on a course of iodide of potassium. As she did not get better, she was sent to me in February, 1862, when I found paralysis of the left rectus internus muscle, which was probably owing to rheumatic effusion. I used Faradisation six times, after which the double vision existed only for objects at a great distance, but not for near things. The patient was then obliged to leave town, but returned in May of the same year, and had ten more applications, after which the muscle had quite recovered, and the double vision disappeared.

CASE XX.—A lady, aged 40, was sent to me by Mr. White Cooper, in October, 1862. She had for some time suffered from mydriasis of the right eye, which considerably interfered with sight. She was otherwise in good health, and unable to account for this affection. I applied a gentle current for a short time, which caused the iris to contract visibly. She was only able to stay in town for a few days, so that the treatment could not receive a full trial; but she was considerably improved even by the short treatment she had followed.

CASE XXI.—A gentleman, aged 49, had for ten months suffered from ptosis of the left eyelid, for which he had undergone a variety of treatment without benefit, when he consulted me in December, 1864. There were many other symptoms, exciting the suspicion of cerebral disease. He had six applications of the continuous current to the eye in a fortnight, during which he recovered the power over the eyelid, although there was no improvement in the other symptoms.

Facial Palsy.

Most cases of paralysis of the portio dura are curable by Galvanisation or Faradisation. The prognosis of the individual case, however, will always be determined by the cause of the affection, and is unfavourable where it is due to malignant disease at the base of the brain, or to caries of the petrous portion of the temporal bone, etc. Facial palsy is, however, most frequently caused by the influence of damp and cold, and subsequent effusion of lymph in the sheath of the facial nerve. If we find that the induced current causes satisfactory contractions of the muscles of the face, Fara-

disation is the best treatment ; while in those cases where we only succeed in inducing contractions by the continuous current, Galvanisation should be employed. The following is a case of the latter kind :—

CASE XXII.—George W——, a shoemaker, aged 44, came under my care at the Infirmary for Epilepsy and Paralysis, on April 25, 1866. He had for the last ten weeks suffered from paralysis of the right portio dura, which he ascribed to having become wet through, and been exposed to a cold draught in a doorway. He was unable to close his eye, to laugh, or to whistle, and could not pronounce the letter ‘f.’ The right nostril was ‘shut up,’ and he had great difficulty in masticating his food at the right side. He also complained of headache, and occasional attacks of vertigo ; but was otherwise in good health. Faradisation produced no contraction in the muscles of the face, while the continuous current caused contractions both on closing and opening the circuit. A continuous current of twenty cells was now applied regularly twice a week, and after six weeks of this treatment the patient had entirely recovered.

Loss of Voice.

Where loss of voice is due to a paralytic affection of the vocal cords, as it is in most cases where it occurs suddenly in girls and young women, in consequence of a cold, or after a mental emotion, Faradisation generally restores the voice in a short time. It also does a great deal of good where the voice is weakened by over-exertion, in clergymen, actors, etc.

CASE XXIII.—In May, 1862, I treated an interesting case of this kind, together with Prof. Czermak, of Prague, who had just then introduced the use of the laryngoscope into this country. It was the case of a patient, aged 30, who had lost her voice two months before, in consequence of a great emotion. An examination of her throat showed that both vocal cords were perfectly motionless and paralysed. After two applications of galvanism, the patient could speak again, although still in a hoarse tone only. It was then discovered, by another examination with the laryngoscope, that the right vocal cord had, to a great extent, recovered its motion, but there was as yet no improvement in the left. By further treatment, the left cord was also brought back to its normal condition, and the voice entirely restored.

Difficulty of Deglutition.

Where difficulty of swallowing is due to paralysis or spasm of the pharynx or œsophagus, Faradisation and Galvanisation are the best, and in many instances, the only means by which we can hope to cure this most troublesome and annoying affection.

CASE XXIV.—Major I., aged 42, consulted me in September, 1862, for loss of voice and difficulty of deglutition, brought on by an apoplectic attack which he had had in 1859, and which affected the entire left side of the body. For several months after this he had been in such a condition that his life was despaired of. He gradually, however, got better, and partially recovered the use of his arm and leg, while the voice and deglutition did not improve. The latter symptom even became worse as time went on, there being constant regurgitation, especially of fluids, which distressed the patient more than anything else. After a fortnight's Faradisation the voice was so much improved that he could converse with ease, while the power of swallowing had not yet returned. I then applied a continuous current to the pharyngeal and œsophageal nerves, with the result that, after the second operation, a remarkable improvement took place; and in a week the patient was able to swallow quite easily, without any regurgitation taking place.

Amblyopia ; Amaurosis ; Weakness of Sight from Imperfect Nutrition of the Optic Nerve.

The medicinal treatment of these affections generally yields little or no result. The various forms of electricity have often been used, and sometimes successfully, although amaurosis, when it has existed for some years, is generally incurable. Galvanisation, however, does a great deal of good in *weakness of sight*, without structural lesions, and which might perhaps merge into amblyopia or amaurosis if allowed to go on unchecked. I have seen a number of cases of this kind, which were due either to over-exertion of the eyes in reading and drawing, or to the influence of too powerful light, or to the general malnutrition of advancing age, and

in which a short galvanic treatment rapidly restored the eyesight to its normal strength. Some of these cases were complicated with photophobia, which yielded to the same remedy.

CASE XXV.—A lady, aged 55, had for the last seven years suffered from weakness of sight, and uncomfortable sensations in both eyes, which she ascribed to her having looked into a glaring light in a concert hall. The eyes generally felt dry and gritty, were easily fatigued by reading, and refused service altogether in the evening. Even weak candle light was extremely unpleasant to her, and she often felt a sharp pain about the brow and in the eyes, after having used them a little longer than usual. She had tried many lotions, embrocations, ointments, and collyria without any but the slightest and most temporary benefit. I used a gentle continuous current for two or three minutes at a time. (April, 1867.) The patient felt more comfortable after the first application, and could use her eyes for two hours in the evening after the second. She had altogether eight applications, after which the eyes felt quite strong, and could be used at all times without the least trouble or discomfort.

Nervous Deafness.

Cases not unfrequently occur in which there is a defect of the power of the brain or the auditory nerve to receive or appreciate sounds, without any physical alterations of the organ of hearing. Such may be properly called cases of 'nervous deafness.' This affection is often accompanied by general debility, and seems to arise from causes which have a tendency to weaken the tone of the nervous centres, such as grief, anxiety, sleeplessness, over-exertion of mind or body, and exhaustive discharges. I have likewise seen it come on during convalescence from acute diseases. Nervous deafness often yields to Galvanisation or Faradisation.

CASE XXVI.—A married lady, aged 46, who had lived much in the tropics, consulted me in March, 1867. Five years ago she had suffered from small-pox, and when she was convalescent her attendants noticed that she had become completely deaf in both ears. She gradually

recovered her health, but not her hearing. She had consulted a number of eminent aurists, who had given their opinion that there was no discoverable lesion of the organ of hearing, but that the deafness was due to a torpid condition of the auditory nerves. A great variety of remedies had been used, both externally and internally, but without effect. I advised the use of the continuous current. Twenty cells produced no sounds, and only a very slight pricking sensation. Thirty cells produced a stronger sensation, but no sounds. Voltaic alternatives were employed. After a fortnight's treatment, the patient heard a slight sound, when the positive pole was in the water filling the meatus, at the moment that the current was broken, while, if the negative pole was used, there was a faint singing noise on making the circuit and the whole time that the circuit remained closed, but nothing on opening it. These phenomena were more distinct in the right than in the left ear. A week afterwards the patient could faintly distinguish the sound of a bell and the musical sound of the hammer of an induction machine with the right ear. After five weeks she could hear the ticking of a clock distinctly with the right ear, and faintly with the left, and could follow conversation if loudly spoken to. The treatment had now to be discontinued, as the patient was obliged to leave London. I heard from her six months afterwards, when she informed me that the right ear had continued to improve, and that she could now hear well with it, while the left ear had remained in the same condition as before.

The following case was treated by Faradisation:—

CASE XXVII.—A married woman, of highly nervous constitution, aged 37, became deaf as far back as 1849, and the only cause she could assign for it was cold. She was always worse when she was excited or embarrassed. There had never been any inflammation of, nor discharge from, the ear; nor was anything pathological in the ear discoverable when Dr. Henry G. Wright examined her at the Samaritan Free Hospital. My examination of the patient's organ of hearing had the same negative result, and the case was therefore put down as one of nervous deafness. Faradisation of the membrana tympani did good at once; the patient who, when she came to me, did not notice any questions I addressed to her, nor heard any sounds produced, heard, on leaving my house, a dog bark, and on turning into Oxford-street, she heard the whistle of an omnibus conductor. From that time she steadily improved, so that it soon became easy to converse with her. At the same time the catamenia, which had been very scanty, became more abundant and of a better character.

Anæsthesia.

Numbness and loss of sensation may be of central or peripheral origin. In the former, Galvanisation is frequently useful, while the latter is better treated by Faradisation. The following is an instance of central anæsthesia cured by the continuous current :—

CASE XXVIII.—A gentleman, aged 64, widower, accustomed to generous living, suffered two years ago from a severe cold and indigestion, after which he was frequently troubled by a very unpleasant sensation of numbness and coldness about the left thigh. Of late he had had the same feeling of cold, heaviness, and numbness about the left side of the head, especially after a chill. Walking had also become rather troublesome. The memory was good, and although the patient had given up active occupation, yet there was no deficiency in his power of application, whenever it seemed to be required. There was a well-marked arcus senilis, and the sense of smell was defective. My opinion on this case was requested by Dr. Allan, of Hyde Park-terrace, in July 1866. We agreed that the symptoms could only be due to want of cerebral power in the right hemisphere, and that the continuous current should be used. I applied fifteen cells to the right side of the head, and thirty to the thigh, with Voltaic alternatives. After four such applications, the sensation of numbness, heaviness, and cold about the head was gone, and two more also relieved the anæsthesia of the thigh.

Spasmodic Diseases.

In chorea, scrivener's palsy, spasmodic wry-neck, stammering, and spasm of the face and the eye, the continuous galvanic current generally proves beneficial. It may also be used in asthma, with a fair chance of success.

Shaking Palsy.

In shaking palsy, Galvanisation of the brain, the sympathetic and the spinal cord, tends to relieve the pain, if such there be, and to check the tremor, especially if this be confined to one or two limbs, and if the case be one of comparatively recent standing. In old cases, and where all the limbs are affected, the prognosis is unfavourable.

CASE XXIX.—A gentleman, aged 42, who had indulged in smoking to an almost incredible extent, his usual allowance during the last 20 years having been between 20 and 30 full-flavoured cigars in the day, consulted me in April, 1866, for shaking palsy of the right arm, which had come on four months ago. The arm, which at first shook only when the patient was excited, or wished to do anything hurriedly, now shook continually, and this shaking was much more violent when he was in any way worried or excited. During the last fortnight, the left arm had also commenced to shake occasionally, but as a rule, it was quiescent. There was no pain either in the right or in the left arm. The patient's general health was tolerable, but his eyesight was extremely weak and dim, and he complained of obstinate constipation. I first made the patient promise to give up smoking altogether, and at once, which he did. I then carefully regulated his diet, and applied the continuous current to the optic, sympathetic, and as cord-nerve current, every other day for a fortnight. At the end of that time, the patient's sight was considerably improved, his bowels were regular, and the arms perfectly steady. Three months afterwards he wrote to say that he had had shaking in the right arm only on one occasion, after having had a considerable annoyance, but that it went off the next day, and that he felt quite well again afterwards.

I have treated a considerable number of cases of shaking palsy of long standing, and where all the limbs were affected, affording considerable relief in most of them; but I have not obtained a cure where both the upper and lower extremities were affected. In some cases, Galvanisation, combined with the subcutaneous injection of morphia and atropia, is followed by much more improvement than by any of these remedial measures used singly.

Epilepsy.

In certain forms of epilepsy which resist other modes of treatment, the continuous galvanic current may do a great deal of good. Faradisation is, as a rule, useless in this disease, as it has no effect on the nervous centres; indeed, the only cases of epilepsy in which it has ever been of service, have been those where the menstrual function was dormant or irregular, and where it proved valuable as an

emmenagogue. The best mode of applying the continuous current is to direct the electrodes to the mastoid processes, the cervical sympathetic, and to those peripheral nerves in the domain of which an aura or warning is repeatedly or occasionally experienced. Where the aura starts from a mucous membrane, the negative electrode should be applied to it; but where it starts from the epigastrium, the positive answers better.

The following are a few of the cases which I have thus treated at the Infirmary for Epilepsy and Paralysis :—

CASE XXX.—*Convulsive Fits and Attacks of Petit Mal—Galvanisation of Medulla Oblongata and Cervical Sympathetic.*

Mary B., aged 16, one of 15 children of the same mother, was admitted an out-patient on February, 5, 1867. Mother says that none of her other children have had fits, but that she had a succession of frights while she was in the family-way with this girl. The patient herself had her first fit after a fright, some other children having “played at ghost” with her in a cellar. This was when she was 5 years of age. Some years afterwards she had another fright, by a woman coming up to her while she was playing in the street, and swearing at her. After this she has never been quite free from fits. The convulsive seizures are well marked, commencing with a scream; the head is turned to the side, there is foam at the mouth, the tongue is bitten, the urine often passed involuntary. The convulsion lasts four or five minutes, during which there is complete loss of consciousness. After the fit the patient sleeps for half an hour or an hour, and then awakes with a bad headache, and speaks slowly and thickly for some time. There is no aura with these fits, which occur at intervals of two or three weeks. Sometimes she has a succession of five or six in the same day; at others only one or two at a time. The attacks of petit mal are much more frequent, as she has sometimes thirty or forty such seizures in one day, and rarely goes two or three days without any. They are as follows :—She suddenly stops in the middle of saying or doing something, stares vacantly, and remains fixed for about a minute, after which a flush spreads over her face, she gives a deep sigh, and then resumes her previous occupation. Intellect dull, memory bad; she seems indifferent to everything; has no power of application; is very irritable and difficult to manage;

appetite ravenous, general health satisfactory. Not yet menstruated. Ordered potass. brom. gr. xv. ter die.

March 12.—Has now taken the bromide rather more than a month and is decidedly better. Has had only three convulsive attacks, which were not so severe as usual; and recovered better from them. Speech improved, looks brighter; and takes more interest in things. Attacks of petit mal the same. Has lately complained much of pain at the back of the head. Ordered to go on with the bromide; empl. lyttæ to nape of neck.

April 5.—No convulsive attacks during the month, but “loses herself” constantly. Continue bromide; gr. $\frac{1}{4}$ of argenti nitr., night and morning.

May 10.—No convulsive seizures; petit mal as bad as ever. Continue bromide, gr. ss. of argenti nitr. bis die.

June 14.—Same report. Galvanisation through both mastoid processes and of cervical sympathetic twice a week. Discontinue argenti nitr.; continue bromide.

July 9.—Much better in every respect. Since galvanism was commenced, has only on three occasions had fits of petit mal, and then only four or five where she had thirty before. Mental health considerably improved.

November 12.—Has had altogether ten applications of galvanism. Had last attack of petit mal early in August; last convulsive attack on March 3. Apparently well. Ceased attendance.

CASE XXXI.—*Epileptic Fits and Auræ; Galvanisation of the Cervical Sympathetic.*

William R., aged 36, married, a blacksmith, admitted February 26, 1867. Eldest child. Mother has been paralysed for ten years, father “has had touches like this.” When he was 7 years old, two bricks fell on his head, and he was very ill some time after. Had his first epileptic fit when 18 years of age, and since then has hardly been free from them for a single month. During the last two years they have been more troublesome, and he has now three or four every week which are of the usual epileptic character. The fit is preceded by what he calls “a rush.” Something seems to rise up from his heart to the left side of the neck and head; these parts begin to tingle and to throb; he gets very hot there; left side of face and neck “looks like pickled cabbage.” The other side of face and neck, never participates in the disturbance. “Rushes” come on frequently without a fit; he feels as if he were “going off,” but does not. He always feels very bad after a “rush;” is bathed in perspiration; “the whole body is in a steam.” Is altogether very nervous, often feels giddy, and is afraid

of being left alone. Tongue yellow, appetite bad ; bowels do not act without medicine ; urine contains sediment of urates. Ordered argent. nitr. gr. $\frac{1}{4}$ bis die ; pil. aloes cum myrrha at bedtime.

March 26.—Digestion improved ; bowels more regular. Fits and auræ the same. Argent. nitr. gr. ss. bis.

April 23.—General health much better ; no improvement in fits and rushes. Arg. nitr. gr. ss. ter.

May 21.—Same report. Discontinue arg. nitr., take potass. brom. gr. xv. ter die.

June 18.—Feels well in himself, but no change in fits and auræ. Potass. brom. gr. xx. ter die.

July 23.—Fits less numerous and less severe. "Rushes" very troublesome. Rep. mist.

October 15.—Has not attended quite regularly since, but has been a good deal better as regards fits. Rushes the same. Rep. mist.

November 26.—No improvement in auræ ; no fits since was here last. Galvanisation of left cervical sympathetic ; continue bromide.

December 10.—No rushes since galvanism was first applied.

January 28.—No fits or auræ since. Discharged cured, after having had ten applications of galvanism.

CASE XXXII.—*Irregular attacks of Petit Mal. Galvanisation of both Hemispheres, and of Medulla Oblongata.*

John F., French polisher, aged 36, married, admitted into the infirmary for epilepsy and paralysis, November 27, 1866, has for the last six years suffered from irregular attacks of petit mal, which come on in the following manner :—While he is at work or at meals, and without any apparent cause, he suddenly feels severe pains in the back of the head, and a thrilling sensation seems to go through him, as if he were going to die. Sometimes it appears to him 'as if a vapour rose on his brain and muddled him.' This lasts only about a second, and he then quite loses his consciousness for about a minute. While he is in this condition, he generally does something odd—for instance, he scratches the plate with a knife, or tears up paper or his clothes, or pulls a handkerchief over his head, or, if in the street, puts mud on his clothes, &c. When he comes out of these attacks, he feels very confused, and sees double for two or three minutes. Within an hour or two he has quite recovered himself. These fits he has two or three times a week, generally only one in one day, and only very rarely two or three successively. He attributes his illness to a great deal of trouble and anxiety. He also had a great fright some years ago, when he was awoken by an alarm of the house being on fire. He has never drunk or smoked to excess. His mother was hysterical, and his father died of

consumption. Digestion had been out of order lately and he had lost flesh. Four years ago he was operated upon for fistula in ano. There was no tubercle in lungs, but general emaciation. Ordered ol. morrh. $\bar{3}$ ss. bis die, and argenti nitr. gr. ss. bis.

January 8, 1867.—Digestion improved; has gained flesh; looks much better; fits much the same. Continue ol. morrh.; argent. nitr. gr. j bis die.

February 5.—Is now in good general health, but petit mal no better. Discontinue ol. morrh. and argent. nitr.; ordered zinci sulph. gr. ij ter die.

March 19.—Zinc has gradually been increased to gr. xxx per diem, but has had no effect except to confine the bowels. Continue it for another fortnight, taking pil. coloc. co. for constipation.

April 2.—Petit mal the same. Ordered misturæ amaræ (consisting of extr. quass. gr. iij to the ounce of water), $\bar{3}$ j. bis, and Galvanisation of both hemispheres and medulla oblongata twice a week.

May 7.—Since Galvanisation was commenced has had only one fit, in which he tore his waistcoat. Rep. mist. amar. and galvanism.

October 15.—Has had altogether fifteen applications of galvanism, and no fit during the last four months. Discharged.

CASE XXXIII.—*Epileptic Fits, with Aura starting from Epigastrium. Frequent Auræ without Fits. Galvanisation of the Solar Plexus.*

Harriet S., aged 26, unmarried, admitted in the infirmary April 25 1866. She is an eldest child, and works at a sewing machine. She had an aunt and a cousin who died of fits. When she was a child of about four years, they gave her a 'roundabout' at a fair, after which she was first taken. When she was fifteen the fits became worse. She had only menstruated at eighteen, and the fits then began to occur chiefly about the menstrual period, although she was by no means quite free 'between times.' She has now generally a series of six or eight fits about the time of the catamenia, and two or three off and on between. The fit is the usual epileptic one, with biting of tongue, and convulsion for about five minutes. It is ushered in by an aura running up from the epigastrium to the head, lasting a minute or half a minute. She describes it as a sort of creeping or crawling, which gradually proceeds upwards, and she loses consciousness when the crawling arrives at the head. Auræ frequent without a fit—sometimes four or five in one day. She fears the auræ very much, as they leave her breathless and in a state of excessive alarm. She says that they are worse at full moon. She sleeps very badly, and is sometimes so

restless at night that she is obliged to take 'a penn'orth of laudanum,' which makes her stupid the day after ; dreams a good deal, generally of horrible things ; is irritable and low spirited ; says that the least thing upsets her so, 'as if she had the palsy' ; appetite ravenous ; bowels costive. Ordered potass. brom. gr. xv. ter die, with ℞ of tinct. hyoscyami ; emplastr. lytt. to epigastrium.

May 23.—At last menstrual period had only two fits instead of six or eight as usual, and none 'between times.' Feels better in herself ; auræ not diminished in frequency, although blister has been repeated three times. Ordered a lotion of equal parts of tincture of iodine and water to be freely applied to starting-point of aura. Continue bromide.

June 16.—Has had one fit since, but says that 'sensations have been dreadful.' Ordered pure tinct. iodi to be applied to the epigastrium.

June 30.—Iodine has blistered the skin ; auræ no better. Positive pole of twenty cells, with large conductor, to solar plexus, negative to ganglion cervicale superius of cervical sympathetic, first at right, then at left side.

July 7.—Was five days without an aura after application of galvanism ; had two yesterday, but they had not nearly the same effect upon her as usual. Rep. galvanism, continue bromide.

August 4.—Has had neither fit nor aura ; mental health wonderfully improved.

October 9.—Has had altogether eleven applications of galvanism. Neither fit nor aura for three months. Discharged.

Asthma.

Dr. Hyde Salter, in his able treatise on asthma, speaks strongly against the employment of galvanism in that disease, and condemns the 'passing galvanic shocks through the chest.' He says that he has known this to do great harm ; to bring on an attack in a patient at the time free from asthma ; that it has, to his knowledge, aggravated existing spasm, but never done any good. Dr. Salter is at a loss to imagine what idea could have suggested the use of galvanism in asthma ; but as he has taken himself great pains to prove that asthma is a nervous affection, depending upon a morbid condition, either of the pneumogastric nerve or the brain, and not upon structural disease of the heart or air-

passages, I am surprised at Dr. Salter's reasoning. I could understand his anathema against galvanism in asthma, if that disease were due to bronchitis, emphysema, or heart-disease; but as he has, with great acumen, made it out to be owing to spastic contraction of the contractile fibre-cells animated by the pneumogastric nerve, Galvanisation of that nerve would appear to be a most rational mode of treatment. Of course we must not think of 'passing galvanic shocks through the chest.' This would be a foolish proceeding, which could in no case be expected to have any beneficial effect. The proper way to apply galvanism in a case of asthma is, to pass a gentle continuous galvanic current through the pneumogastric nerve at the neck, for one or two minutes. With this mode of application I have produced satisfactory results in two cases of spasmodic asthma, which had obstinately resisted a variety of purely medicinal treatment.

Stammering.

The best mode of treating stammering is systematically to educate the vocal organs; but where this is slow to act, or seems to fail, the continuous current may be of service in conjunction with it.

CASE XXXIV.—An intelligent boy, aged 9, one of ten children, was brought to me in January 1868. His general health was tolerably good, but ever since his fourth year he had suffered from defective speech. He could only talk fluently when he was excited, but otherwise he stammered very much. He complained of headache and occasional dizziness, and the pupils were excessively large. Having some suspicion of masturbation, I examined the sexual organs, and found a high degree of congenital phimosis, which appeared to produce considerable irritation. I therefore, before resorting to any further treatment, sent him to Mr. Curling to be circumcised, which was done in February 1868. In consequence of this operation the general health improved, but the spasm in the throat was still as bad as ever. I therefore now applied the continuous current to the laryngeal nerves continuatively, giving at

the same time directions for a gymnastic education of the voice. After two months' treatment, the patient attending twice a week, he was very much improved; and when I saw him again, four months afterwards, he spoke as well as could be wished.

Neuralgia.

Neuralgia is generally due to impaired nutrition of nervous matter, unaccompanied with any severe structural lesions, and often yields rapidly to Galvanisation and Faradisation.

Neuralgia of the Face.

This comes on frequently after exposure to damp and cold, or after mental emotions and prolonged anxiety. The most severe form of it occurs in advanced age, and only yields to the continuous current, while the milder forms of facial neuralgia are often cured by Faradisation, or even static electricity. The following case is one of the latter kind, which readily yielded to Faradisation:—

CASE XXXV.—A married lady, aged 28, had been in good health until May 1857, when, in consequence of having got wet through, she was seized with violent pains in the right side of the face, accompanied at first by fever and general indisposition. The latter symptoms soon subsided, but severe shooting pains continued to occur in paroxysms, at the end of which the patient was completely exhausted. For the first few weeks the attacks of pain came on very irregularly, about four or five times in the course of the day; but they gradually assumed an intermittent character, only one attack occurring every other day, between four and five o'clock in the afternoon. Large doses of quinine and arsenic had been given, but without producing any effect; the patient had also been treated with calomel, bichloride of mercury, iodide of potassium, and blisters. Her general health had much suffered, and she had become nervous and irritable. She now (October 1857) always had a warning that an attack was coming on, viz., a kind of tickling in the epigastrium, followed by a sensation of pins and needles in the face. Soon after the pain begins to shoot through the zygomatic bone, the lower eyelid, the cheek, and chin, is less violent on the nape of the neck, and spares the forehead and temple. Such an attack usually lasts about half an hour, and then slowly subsides into a dull aching pain,

which continues for three or four hours. The following day she is free from pain, but on the third day there is another paroxysm. Movements of the face do not increase the pain. On examination of the face, I found two *puncta dolorosa*, viz., on the zygomatic bone, where the temporo-malar, and on the infra-orbital foramen, where the infra-orbital nerve emerges from the orbit; pressure on these two points caused a distinctly painful sensation in the free interval. I used Faradisation, directing the electrodes alternately to these two points, by means of moistened conductors, conveying a rapidly-interrupted current to the suffering nerves. The first application, made at the time when the attack had just commenced, relieved the severity of the pain, but did not shorten the duration of the paroxysm. Two days after, another attack came on in due time, but was then much shortened by Faradisation. On the third day after that, there were premonitory symptoms, as usual, but no attack. Next time, a paroxysm came on, which was subdued in five minutes. Faradisation was used five times more, after which the patient appeared to be free from the disease. I saw her again in the beginning of June 1858, when she told me that up to that time she had been perfectly well.

The following case was cured by the continuous current:—

CASE XXXVI.—A married lady, aged 41, came under my care in August 1862. She had, for the last twenty-five years, with few intermissions, suffered from Fothergill's disease, which attacked the left side of the face, and more especially the temple, cheek, and chin. The pain was most violent between six o'clock in the evening and two or three in the morning, and prevented sleep until then. It was worse in damp weather and when easterly winds prevailed, and was excited by the least movement of the face, especially the lips. Almost every narcotic had been used for relieving her, but generally with the effect that the pain was increased instead of diminished. This was chiefly the case with opiates, belladonna, and henbane; arsenic and quinine had also been given, but failed. I applied a continuous galvanic current of four cells of Bunsen's battery to the two inferior branches of the trigeminal nerve, and ordered at the same time the internal use of Spa water for improving the general health. Three operations, which were very pleasant to the patient, were sufficient to cure her of a disease which had for twenty-five years embittered her life; and up to December, 1863, when I last heard from her, no relapse had taken place.

Headaches.

There are few headaches which resist Faradisation by the electric hand, or a gentle continuous current ; but we should at the same time not neglect to enquire into any derangements of the stomach or other organs which may be present, and which are so frequently instrumental in producing headaches. Yet many cases occur where a judicious medicinal treatment entirely fails in relieving the headache, and where this is promptly cured by electricity. I have notes of many such cases, in which either of the above mentioned methods of applying galvanism proved successful.

A frequent and peculiar form of headache is the *sick headache* (hemicrania). This generally resists not only medicinal treatment, but also Faradisation by the electric hand ; it yields however to the continuous current, applied through the mastoid processes and the temples.

Sciatica.

In sciatica, Faradisation as well as Galvanisation, often prove successful. It is sometimes advisable to combine them with subcutaneous injections of morphia and atropia.

CASE XXXVII.—A Scotch farmer, aged 35, came under my care in July 1857. He had never been in strong health, and suffered for a long time from acidity in the stomach. Eight years ago he had his left thigh amputated for tumor albus ; and he wears now an artificial leg, which, being very heavy, exerts a great strain upon the left side of the pelvis. Three years ago, he first began to feel pain on the back of the right thigh, and on the inside of the leg, down to the ankle. The pain having been dull and heavy for some time, soon became keen and acute, so that the patient was laid up by it. He thought it was brought on by his having taken too much exercise. He did not suffer from violent paroxysms of pain, followed by free intervals, but had no rest whatever. He placed himself under the care of two of the most eminent practitioners of Edinburgh, and after some time was much relieved, the acuteness of the pain slowly but gradually subsiding.

He then left Edinburgh; but being still very bad, acupuncture was resorted to, from which he received immediate relief, but the pain never entirely left him, and was much about the same shortly after the operation. About two years afterwards he came to town and consulted Sir James Clark, who sent him to me. The pain was "a dull ache" at that time; it increased much on walking, even for a short distance, and in the first part of the night. Pressure had no marked influence upon the pain; but it rather relieved than increased it. The muscles of the leg twitched a good deal in the morning, but not much in the course of the day; these twitches were quite painless, and no doubt due to mal-nutrition of the limb. I used Faradisation of the skin, by wire brushes, but as two such applications produced no effect, I applied the next day moistened electrodes, placing the positive one to the tuberosity of the ischium, and the negative to the ankle, for six minutes. Immediately after this application the pain was quite gone; it returned three hours after the operation, but was not nearly so severe as it had been before, and the patient had a very good night's rest. I repeated the operation three times more; after the second, the pain went away till the following morning; and, after the fourth, it was only slightly felt in walking, but not while in a quiescent position. The patient was then obliged to leave town, and six weeks afterwards I received a note from him stating that since Faradisation was used, the limb had been a good deal better. He was, however, not totally free from pain when he walked to any distance; yet the pain went off sooner, was less severe, and not so liable to return as formerly. I therefore advised him to undergo another course of the same treatment. This the patient did some time afterwards. Faradisation was used six times more as above, and with such beneficial effects that he was no longer in pain, even when walking three or four miles at a time.

CASE XXXVIII.—A retired general officer, aged 50, came under my care in October 1867. With the exception of a bad attack of dysentery, which he had had in China about twenty years ago, he had always been in good health until about eighteen months ago, when he got wet through and was unable to change his clothes for some time. The next day a severe attack of sciatica came on in the left leg, which was treated by leeches and blue pill. About a month afterwards he was able to leave his bed, but the pain had continued ever since. It increased on walking, and was very troublesome at night. Both thigh and leg were considerably wasted, there being a difference of two inches in the thigh, and three quarters of an inch in the leg, compared to that of the other side. His weight had also considerably diminished, being more than a stone less than before. There was incomplete

anæsthesia of the skin from the hip downwards. The sense of temperature was considerably diminished, and there were fibrillary twitches in the muscles of the leg. Digestion was impaired and costiveness habitual. There was an excess of urates in the urine, and the expulsive power of the bladder had become somewhat diminished. The patient often suffered from headache and restlessness at night. The pain was most severe about the incisura ischii and the knee-joint; but it was also bad in the calf of the leg, especially after attempting to walk. I prescribed Vichy water for correcting the excess of acidity, and applied the positive pole of the continuous current of thirty cells continuatively, by means of a conductor of large surface (three inches diameter) to those points of the nerve which were painful on pressure, the negative pole being placed in the neighbourhood. The wasted muscles were afterwards faradised. The pain was considerably less after the first application, and completely disappeared after six. The current was now employed intermittently for relieving the anæsthesia. Within a month the thigh and leg had recovered their usual bulk; the patient was again able to take regular walking exercise, digestion was improved, and the excess of urates had disappeared from the urine. He called upon me in February 1869, and informed me that he had been quite well ever since.

The following is a case of diffuse neuralgia, which yielded rapidly to Faradisation :—

CASE XXXIX.—The patient was a merchant, aged 30, of vigorous constitution, and active habits. He was a passenger by the Canadian steamer, which foundered at sea on the 4th of June, 1861, about 200 miles off the coast of Canada. Many of the passengers were drowned; but this gentleman, by means of a life-buoy, was enabled to float until, three-quarters of an hour afterwards, he was picked up by a boat which was passing. Life was then almost extinct. The water was at the time very little above freezing-point, as large masses of ice were floating in it. The patient, however, soon rallied; but unfortunately he had to remain in his wet clothes for a considerable time; and, even when he landed, he could not at once obtain a change of dress. He did not at first experience any ill effects from this accident; but, after some time, he began to feel severe burning pain in the arms and legs; and when the pain subsided, he perceived numbness in the limbs and loss of muscular power. He soon afterwards returned to England, and was, during his passage, subjected to treatment by the ship-surgeon, who prescribed anodyne applications, as opium, aconite, etc., to the arms, and general tonics; but he derived no benefit whatever from the remedies used. On his arrival in this country, he consulted Mr.

Snape, of Bolton-le-Moor, who thought that Faradisation would be the best means of restoring him, and sent him to me. On examination, I found the following morbid symptoms:—1st, as regards the sentient nerves: there was a burning neuralgic pain, especially in the fore-arms and thighs, which increased very much towards evening and in the night; so that the patient was prevented from sleeping, and in consequence became much exhausted in the morning. There was also anæsthesia, especially in the right hand and fore-arm, where the prick of a pin could not be felt; while, on other parts, it was only obtusely felt, and not as a prick, but as a mere touch. The sense of touch, especially in the right hand, was much diminished. Finally, there was a semi-paralytic condition of the arms; the patient could move them, but he had no power over the muscles; he could not grasp anything with force, and experienced great difficulty in writing. The contractility of the muscles was not diminished, as they answered readily to an electric current of moderate power, only the influence of volition over them had considerably decreased. The flexor muscles of the fore-arm were most affected. The general health of the patient was good, notwithstanding the loss of rest, and the wear and tear consequent upon great suffering. I used Faradisation of the skin and the suffering muscles, with excellent results. The pain, which was very severe at the time the patient came to me, disappeared during the first application; and he slept soundly the following night. The pain returned in the morning, although in a less degree; and, after a few more applications, it was entirely subdued. The anæsthesia also yielded rapidly to the means employed. After three operations, the patient was again able to feel distinctly, not only the prick of a pin wherever I applied it, but also the mere touch of blunt instruments; and when he left town, after having been under my care for six days, he was quite free from pain, the anæsthesia was gone, the sense of touch was again normal, and the muscular power had returned. I have not seen him since; but Mr. Snape has written to me to say that the effects of the treatment have been permanent, and that the patient returned some time afterwards to Canada, in perfect health.

Spinal Weakness.

Atony of the spinal cord not unfrequently occurs without any structural disease, and is often not recognised, because many medical practitioners look upon the complaints of these patients as the mere offspring of a disordered imagination, and, therefore, class them under the convenient name

of hypochondriasis, if the patients belong to the male sex ; and of hysteria, if occurring in women. The illness of such patients, however, is not imaginary, but real, and they suffer quite as much as if they were affected by some organic disease. One form of spinal weakness has, as chief symptoms, weakness and irritability of the nervous system (commonly called nervousness), together with imperfect digestion, and increased elimination of urea by the urine. Of this form, which I have reason to believe to be very frequent, the following is a good example :—

CASE XL.—F. S., aged 42, a gentleman actively engaged in speculative business, had to do unusually hard work, and to undergo considerable anxiety during the autumn of 1865. He had felt nervous and irritable for a long time previous to this ; but the first symptom of real illness which supervened was sleeplessness, which commenced in November, 1865, and gradually got worse until March, 1866. He either did not go to sleep at all on getting into bed, or if he dropped asleep from utter weariness, he woke up again in about half-an-hour, and lay restless during the remainder of the night. Besides this he complained of a feeling of great exhaustion, total disinclination to work, and to bodily exercise of any kind ; of weakness in the back, and pain at the nape of the neck. He was easily excited and worried by little things, and extremely intolerant of noise, or of being asked any questions. He was frequently troubled with a sense of vague alarm and distressing sensations in the head. He disliked his meals, and generally suffered from heaviness on the chest, flatulence and acidity, which seemed to be quite independent of the quality or quantity of the food taken, and which came on chiefly after any mental emotion or excitement. He was also much inconvenienced by frequent calls to pass the urine, especially in the morning, after breakfast. The analysis of the urine showed at once the nature of the morbid condition, as I found it to contain a considerable excess of urea. I now examined the urine daily for some time, and found that this excess of urea was not accidental, but constant. The body-weight of the patient was 11 stone 3 pounds, and the daily quantity of urea excreted by him should therefore have been about 550 grains. It was however continually several hundred grains in excess of this, as shown in the following table :—

March.	Number of fluid ounces of urine passed in 24 hours.	Specific gravity of urine.	Quantity of urea, in grains.	Morbid excess of urea, in grains.	Treatment.
10	66	1027	920	370	Galvanism.
11	64½	1027	900	350	
12	67	1027	934	384	Galvanism.
13	63	1027	878	328	
14	65½	1027	904	354	Galvanism.
15	61	1027	850	300	
16	62	1027	864	314	Galvanism.
17	58	1027	808	258	
18	not noted.	not noted.	not noted.	not noted.	
19	"	"	"	"	
20	56	1027	780	230	Galvanism.
21	52	1027	724	174	
22	57½	1027	801	251	Galvanism.
23	46	1026	638	88	
24	52	1026	721	171	
25	not noted.	not noted.	not noted.	not noted.	
26	57	1026	790	240	Galvanism.
27	52	1025	718	168	
28	48	1025	662	112	Galvanism.
29	47	1025	649	99	
30	49	1024	671	121	
31	44	1024	603	53	Galvanism.
April 1	not noted.	not noted.	not noted.	not noted.	
2	"	"	"	"	Galvanism.
3	42	1023	557	7	
4	46	1023	611	61	Galvanism.
5	43	1022	554	4	

This patient was treated with nothing but the application of the continuous galvanic current, as cord- and cord-nerve-root- current, with Voltaic alternatives. The influence of each application in diminishing the excretion of urea is well shown in the table; and the improvement in the general health went *pari passu* with this. The patient had three hours' uninterrupted sleep after the first application of galvanism,

and that most troublesome symptom, sleeplessness, which had resisted morphine, was soon entirely removed. After three weeks' treatment the patient felt like another man, being again able to exert himself both mentally and bodily, to enjoy his meals, and to take an interest in the concerns of daily life.

The case just related, to which I might add a dozen others, shows in a striking manner how much the functions of digestion and urinary secretion are under the influence of the nervous system. Patients of this class have no disease of the stomach or the kidneys, as they are often inclined to believe, but suffer from spinal weakness, that is, functional disorder of the spinal cord, which, in my opinion, consists chiefly of a deficiency or perversion of the current of animal electricity, which Professor Dubois-Reymond, of Berlin has shown to pass through the cord in its normal condition. Dr. Ranke, of Munich, has proved by experiments on animals, that, if this current proper of the cord is deficient, the animals suffer from a morbid increase of reflex excitability, and are often in a miserable and wretched state of health. He also found that in such animals this morbid reflex excitability could be removed by the application to the cord of a continuous galvanic current. I have myself found that in patients suffering from nervousness, dyspepsia, and increased elimination of urea, the most effective means of cure is the application of the cord- and cord-nerve-root- current. No doubt patients of this class often derive great benefit from rest, change of air, mineral acids, arsenic, nitrate of silver, and other nerve-tonics; yet in almost all cases which I have had under my care, some remedies of this kind had already been employed without much or any result: and I am satisfied that none of them equal in efficacy and quickness of effect the continuous galvanic current. If applied in the manner described above, the current has no direct effect on the stomach, and yet it

cures dyspepsia ; it has no immediate action on the kidneys, and yet it checks the morbidly-increased elimination of urea ; it has, however, a most decided and powerful influence on the molecular condition of the ganglion-cells of the spinal cord, and chiefly on the current of animal electricity to which I have just alluded. In strengthening this current, where it is weak ; in correcting it where its direction may be perverted, it not only does away with the symptoms of weakness and morbid excitability more immediately depending upon the pathological condition of the cord, but it also indirectly cures those symptoms on the part of remote organs, such as the stomach and kidneys, which are due, not to a disease of their own structure, but to a perverted and diminished nervous supply, which prevents them from properly fulfilling the part they are meant to play in the system.

Progressive Muscular Atrophy.

The prognosis in this disease is no longer so bad as it was formerly, since the continuous current, applied to the sympathetic nerve and the spinal cord, has been shown to exert a decidedly curative effect in such cases. The partial form is, of course, always more curable than the general form of the disease.

Rheumatism and Serous Effusions.

In acute and chronic rheumatism of the muscles, both Faradisation and Galvanisation, when properly employed, are invaluable remedies. I have frequently cured cases of very long standing, and in which the patients had almost despaired of a cure, by one or two applications. Rheumatic effusions in the joints are likewise amenable to faradisation, which must in this instance be continued somewhat longer than is necessary for the relief of muscular rheumatism. If,

however, the effusions are considerable, Galvanisation is preferable to Faradisation; and both remedies may be used together, if muscular contractions are present. These contractions, which frequently resist a purely medicinal treatment, are readily cured by a proper use of the continuous and induced current.

CASE XLI. — T. C., a musician, aged 31, had, during a tour in Scotland, in the summer of 1859, contracted severe rheumatism in the right shoulder and arm, which prevented him from following his occupation. He had followed various courses of treatment, and taken large quantities of nitre, bicarbonate of soda, iodide of potassium, and guajac. The pain was relieved after a time, but it never entirely left him, and a considerable contraction of the flexor muscles, both of the arm and fore-arm, remained, for which all remedies proved useless. He consulted me in September, 1861, when I found the arm in the following condition:—There was a certain degree of anæsthesia in the arm, for the patient did not feel the prick of a pin, nor could he distinguish the two points of the æsthesiometer when held at the usual distance. He complained of a dull aching pain, which at times became acute, and was very severe when he got into bed. The fingers were very numb. The biceps and brachialis internus muscles were so contracted that the arm was flexed in an angle of about 65° , and could not be extended; the flexor digitorum communis was also rigid, although in a less considerable degree, and the interossei and lumbricals were so much wasted, that the hand was nearly useless. The bulk of both arm and fore-arm was considerably diminished, being only ten and a half inches at a point eight inches downward from the acromion, and only nine inches at a point three inches downwards from the olecranon; the corresponding numbers for the left arm being thirteen and ten and a quarter. The general health of the patient was tolerably good, but the appetite was indifferent, and the urine was loaded with urates. I prescribed Vichy water to be taken internally, and Faradisation and Galvanisation of the right arm. The result of this treatment was most satisfactory. In the course of a week the pain disappeared. Soon afterwards, the rigidity of the muscles began to subside, sensation was re-established, and the right arm increased so much in bulk, that after three weeks it equalled the left. In the meantime the urine had, by the use of Vichy water, become quite clear, and the appetite was much better. The interossei and lumbrical muscles were most stubborn, and only showed signs of improvement at the end of the third week. They then rapidly

regained power, and when the patient discontinued the treatment after having been under my care for five weeks, he was in every respect in excellent health, and able to resume his avocation.

CASE XLII.—*Rheumatism in the Shoulder.*

Dr. T., aged 47, had been a sufferer from rheumatism in the left shoulder for more than seven years, when he came under my care (1857). He had tried almost every means for the relief of the pain, which, especially in autumn and winter, became very troublesome; he had also used galvanism, applied in the old-fashioned way of sending the current through both arms, but without any beneficial effect. Faradisation of the skin was resorted to, and, after two operations, the pain was gone and has not since returned.

CASE XLIII.—*Rheumatism in the Knee-joint.*

An officer, aged 34, came under my care in February, 1867. He had been a long time in India, and had for the last three or four years suffered severely from rheumatism in the knee. Six months ago he had a course of the waters of Aix-la-Chapelle, which, however, did him no good; and a large number of other remedies, both internal and external, had been used and found wanting. The right knee-joint was somewhat enlarged, and there was incomplete anæsthesia in front of the joint. The positive pole of forty-five cells was applied to the knee for five minutes, the negative pole being placed alternately to the thigh and the leg. After the first application the pain went away completely for six hours, and after the second the patient remained free from pain for a whole day. The applications were continued every other day, and after the patient had been under my treatment for a month, he had completely recovered.

Rheumatic gout yields to the continuous current, but the treatment must be persevered in for a considerable time.

Opacities of the Cornea.

The slighter kinds of opacities, which are termed *nebulae*, yield readily to the application of the continuous current, while thick opacities (*leucoma*) are more obstinate.

CASE XLIV.—H. T., aged 19, received in May, 1862, a violent blow on the left temple from a cricket-ball. He was at first quite stunned, and felt great pain in the head for several days afterwards.

The conjunctiva and cornea of the left eye then became inflamed, for which the patient was put on a course of mercury; but although his system was much affected by that drug, the eye did not get better. Mercury was therefore given up after a time, and other treatment resorted to. The inflammation gradually subsided, but a considerable opacity remained, which covered the whole extent of the cornea, and was thickest in the lower portion of that membrane. Vision was almost entirely prevented by it. Mr. White Cooper, whom the patient consulted in July, 1862, thought that electricity would be the best means of promoting the absorption of the opacity, and sent him to me. I combined Faradisation with Galvanisation, the negative pole being directed to the closed eye, and the positive to the temple, so as to stimulate the influence of the first branch of the trigeminal nerve upon the nutritive processes in the eye. The patient quickly improved under this treatment; and when he discontinued it, after having had twenty-four applications, there only remained a very thin film on the cornea, which was but perceptible on close examination, and impeded vision scarcely at all. A complete cure would probably have resulted, if the patient, who did not live in town, had been able to pursue the treatment a little longer.

Ozæna.

In cases of ozæna which resist a constitutional treatment, and washing out the cavity of the nose, a combination of electrolysis with Faradisation may be usefully employed. By electrolysis the clots of congealed mucus which plug up the nostrils are melted and removed, while Faradisation affords a healthy stimulus to the mucous membrane, and enables it to return to its normal condition. Constitutional remedies, however, should not be neglected while electricity is being used.

Dyspepsia.

In most forms of dyspepsia Faradisation of the stomach and intestines, and Galvanisation of the cervical sympathetic, are useful, but more especially in that form which is called 'nervous indigestion.' A special form of dyspepsia, which is connected with increased elimination of urea, has already been considered (p. 572).

Habitual Constipation.

The treatment of habitual constipation by diet, regimen, and medicines, is frequently unsuccessful; while Faradisation of the bowel generally overcomes that most troublesome affection, even after immense quantities of purgatives have been ineffectually taken, and after years of mental and bodily distress to the patients.

CASE XLV.—A hard-working merchant, aged 38, first consulted me in June, 1865, for a troublesome form of dyspepsia, from which he had suffered for many years past. He complained of a feeling of heaviness and oppression after meals, especially after breakfast, coupled with eructations and flatus, which latter gave rise to acute pain until they were discharged. The bowels had been habitually costive ever since a journey the patient had undertaken to the west coast of Africa, in 1857, where he had suffered from a bad form of dysentery. From that time he had been obliged to “assist the bowels” with purgatives. He had also used enemata of various kinds, but the rectum seemed to resent them, and the patient had taken a great dislike to their use. The tongue was dry and furred. The patient had lost flesh lately, in consequence of being compelled to restrict his food to the smallest possible quantity. The urine was clear; the motions dark, hard, and ill-formed.

I carefully regulated the diet, and prescribed a tumblerful of Eger water night and morning, and five grains of carbonate of bismuth twice a day after meals. Digestion and defecation soon improved under this treatment, so that the patient was able to take more food than before, and he felt and looked much healthier and stronger than he had done for a considerable time past. About two months after I first saw him, business obliged him to return to Africa, and I did not see him again till March 1866, when he was very much worse than he had ever been before. He had been obliged in the interval to take strong purgatives habitually, for ensuring sufficient action of the bowels. Indigestion and costiveness were now more troublesome than ever. The patient was emaciated and exhausted to the last degree. He was unable to do any work or take any exercise, and refused all nourishing food, so that his family were extremely alarmed about his condition. Under these circumstances, an energetically tonic plan of treatment appeared indispensable. I prescribed liquor arsenicalis, with vinum ferri, a dose of pancreatic emulsion in rum and milk twice a day, a compound rhubarb

pill, with the twenty-fourth part of a grain of strychnia at bedtime, and Faradisation of the bowel twice a week. Under the influence of this treatment the patient rallied wonderfully. The beneficial effects of Faradisation in inducing a healthy action of the mucous and muscular coat of the bowel were well shown by the circumstance, that there was always a very good motion the evening after the application of the electricity, while on those days where it was not applied the action was rather sluggish. At the end of a month the pill was discontinued; the arsenic was taken for another fortnight, and the emulsion for a month more. Faradisation was discontinued at the end of three months, when digestion and defecation were normal. Ever since that time the patient has been in good health, and taken no medicine whatever.

CASE XLVI.—An unmarried lady, aged 43, tall, of sallow complexion and sedentary habits, consulted me on Feb. 2nd, 1866, for a “nervous affection,” from which she had suffered for many months past. She complained of a constant dull headache, of giddiness on rising in the morning, a wearying feeling of mental depression, and frequent flushings of the face and ears. Her hands and feet were habitually cold. Her sleep was unrefreshing, being disturbed by unpleasant dreams; and too short, for she slept on the average only two or three hours a night. Her intellect and memory were as good as ever, but she found it difficult to fix her attention on any subject, and felt a distressing sensation of pressure on the head after reading or writing. The latter circumstance annoyed her a good deal, as she had been a zealous supporter of various philanthropic undertakings, which required a considerable amount of correspondence. She was sometimes troubled with palpitations of the heart; the heart’s sounds were weak; the pulse small and feeble. The breath was generally short; the chest otherwise healthy. The tongue was dry, and covered with a yellowish white coat. The appetite was feeble, and digestion tedious and painful. For many years past the patient had suffered from obstinate constipation, for which she habitually took purgatives. If she attempted to do without any, she felt great pelvic distress, especially in walking and standing, and considerable increase of all the head symptoms. She had chiefly taken cremor tartari, aloes, nux vomica, colocynth, scammony, and podophillin. The evacuations were hard and ill-formed. The urine was generally scanty and highly turbid, and she had often a scalding sensation in passing it. She had a small fibroid tumour of the uterus, for which she had consulted several obstetric physicians, who had advised that it should be let alone. At the time of the catamenia her suffering increased very much indeed. Purgatives then seemed to augment the menstrual flow to an alarming

extent ; it often, in fact, amounted to true menorrhagia, which lasted for ten or twelve days. She therefore generally took much smaller doses of purgatives during that time ; with the effect that the loss of blood was not so copious, while, on the other hand, the pain and discomfort about her head were so dreadful that she often thought she would lose her senses. Her habitual dose of purgatives was now two teaspoonfuls of cream of tartar twice a day, and ten grains of compound colocynth pill at bed-time.

As she had lived too exclusively on meat diet, I ordered her to take boiled fruit and saccharine vegetables ; to discontinue the cream of tartar entirely ; to take five grains of compound colocynth pill at bed-time, and a tumblerful of Marienbad water twice during the day ; and finally, to take as much exercise in the open air as possible, without fatigue.

Feb. 25th.—Has found great relief from the change in her diet, and from the Marienbad water. Last period was more comfortable than it had been for many months past. Has not been able to take much exercise because it brought on palpitations of the heart. Ordered to go on as before, but to take the colocynth pill only every other night.

March 18th.—Has been worse for the last week or ten days. The Marienbad water seems to have lost its effect. Has been obliged to take ten grains of colocynth pill daily for the last few nights. Head most uncomfortable ; extreme depression of spirits. I now substituted Friedrichshall for Marienbad water, and allowed her to take five grains of colocynth pill every night.

April 20th.—The last period was just as bad as ever. The Friedrichshall water only relieves constipation when taken in large doses, which she believes to be lowering, and is ineffectual as soon as the dose is reduced. I now proposed to the patient the application of galvanism for inducing a healthier action of the bowels ; and as she consented at once, I sent a current of moderate power for fifteen minutes through the intestines. The patient did not complain of any pain or discomfort from the application, but said she felt more exhilarated and hopeful than she had done for a long time.

24th.—She came to me in high spirits, saying that since the Faradisation was used she had every day had a better motion than for many months past. I ordered her now to discontinue the colocynth pill entirely, and merely to take a wineglassful of Friedrichshall water twice a-day.

From that time forward the patient made an uninterrupted recovery. Faradisation was continued twice a week for a month, after which neither medicines nor mineral waters nor the galvanic stimulus were any longer required. The head symptoms disappeared gradually in

proportion as the action of the bowels was restored ; and when I last saw the patient (July, 1867) she was perfectly well, excepting the somewhat too copious menstruation, which was now the only trouble she experienced from the fibroid tumour of the uterus.

Tympanites and Flatulency.

Tympanitic distension of the abdomen is owing to intestinal atony, and loss of power in the abdominal muscles ; the intestines, therefore, meet with no resistance, and become considerably distended. This condition is frequently observed in hysterical women ; after partaking of indigestible food ; in acute diseases, especially typhus, pneumonia, small-pox, puerperal fever, peritonitis, etc. If the tympanites is very severe, it threatens life, as it may produce asphyxia by paralysis of the diaphragm, and compression of the lungs. A purely medicinal treatment often fails to relieve it, and Faradisation or Galvanisation should therefore be employed if the tympanites does not yield readily to other remedies.

CASE XLVII.—*Extreme Meteorism after Ovariectomy.*

A married woman, aged 37, mother of one healthy child, twenty-two months old, came from Aberdeen to London, in April, 1863, in order to consult Mr. Spencer Wells for a large ovarian tumour, which had begun to form in July, 1862, and had rapidly increased after August of the same year. The patient had a dark and rather sallow complexion, and had become much emaciated during the last two months. The tongue was clean, the appetite pretty good, the bowels were naturally open, but she complained of troublesome flatulence. The breathing was only slightly affected ; there was no cough, and no expectoration. The catamenia had ceased in September, 1862. The pulse was at 120. The girth at the umbilical level was forty-nine inches. She had been tapped seven times, but had always refilled rapidly. Mr. Wells performed ovariectomy upon her on April 29. There were strong and extensive parietal adhesions, both anteriorly and laterally ; thirty-three pints of fluid were removed, and the cyst and solid matter taken away weighed thirteen pounds thirteen ounces. Without going further into the details of the case, I will only say that the patient went on fairly, excepting the immense distension of the stomach and bowels by gas,

which was so great as to threaten life. After the most efficacious medicines had been taken without improvement, Mr. Wells believed that Faradisation was necessary, and requested me to see the patient. I saw her on May 18, when the flatulent distension was so great that the left lung was almost entirely compressed, the heart being dislodged to the right side, and there being tympanitic sound in the second intercostal space. I performed Faradisation, after which the patient had a considerable discharge of flatus. On May 19, I repeated the operation, and the patient then had two motions, one of them solid. I operated upon her four times more, after which the lung had again expanded to its normal volume, and the patient being nearly well, I discontinued the treatment. On May 26 she went on board the steamer which was to sail the day following for Dundee. The patient died at home in the commencement of August from malignant disease, which had very rapidly formed; but both Mr. Spencer Wells and Sir William Jenner, who had also seen her, were of opinion that if she had not been faradised, she would have died in London from the effects of the meteorism.

Habitual Flatulency.

CASE XLVIII.—A gentleman, aged 46, had dysentery fifteen years ago, and had ever since suffered from flatulency, which was extremely troublesome. He was otherwise in good health, but the flatulency never left him even for one day, and was so bad after meals that he was obliged to lie down for an hour or two afterwards. The examination of the abdomen showed no tumour or obstruction, but merely a considerable accumulation of gas in the large intestines. He had used a great many remedies without success, especially charcoal and belladonna. I galvanised the bowel with a current of twenty-five cells, the positive pole being in the rectum, and the negative electrode being passed over the abdominal parietes. The patient felt very comfortable for some hours after the first application, and the flatulency only returned in the afternoon. After four more operations, the patient passed a whole day without feeling troubled with flatulence; and after three weeks he was quite free from it.

Diseases of the Heart.

Galvanisation of the sympathetic and pneumogastric nerve may be used in those numerous cases of heart disease where the usual remedies fail to give relief to the sufferings of the patient.

Paralysis of the Bladder.

This most annoying affection sometimes comes on after childbirth, or after the desire to empty the organ has not been complied with, as when travelling by express train, etc. A dose of belladonna or atropine, in the aged, will sometimes completely paralyse the bladder, and so will morphine. The affection is altogether more common in the aged than in youth or middle life. It frequently accompanies diseases of the nervous centres, and senile enlargement of the prostate. Whatever may be its cause, Faradisation, if judiciously performed, is the most effective remedy for it; but it must, in enlargement of the prostate, be combined with Galvanisation of that organ.

Incontinence of urine, from irritability of the bladder, may, if this be a functional derangement, unaccompanied with structural disease, such as calculus, tumour, etc., be cured by Galvanisation. The precaution must, however, be taken of merely applying the negative pole to the bladder itself, as the application of the positive pole to that organ would only increase its irritability.

Impotency and *Spermatorrhœa* frequently yield to the local application of electricity to the suffering parts.

Amenorrhœa.

Where menstruation is scanty or absent, in consequence of engorgement and inflammation, or where the function has not been established, in young women, owing to a torpid state of the vasomotor nerves of the ovaries and uterus, or where it has been stopped in consequence of shock, mental anxiety, and similar causes, Faradisation is one of the best remedies for regulating this important function.

I subjoin a case of amenorrhœa which presents some

interest, partly on account of the advanced age of the patient, and partly because electricity was not used with the intention of effecting a return of menstruation:—

CASE XLIX.—A married woman, aged 48, was admitted as an out-patient at the Infirmary for Epilepsy and Paralysis, under my care, on May 5, 1866. Six years ago she had a paralytic stroke which took away the use of the left side. She was then so ill for three months that her life was despaired of. She had had many miscarriages, and several children, but none of them were now living. Shortly before she had the attack, the courses stopped away, she being then 42 years old; when she first missed them, she had a great deal of pain in the back and suffered from sick headaches. She had never seen a sign of them since. She had now nearly recovered the use of the arm, but there was almost complete anæsthesia of the left leg from the knee downwards, and walking was very troublesome. I resorted to Faradisation of the skin of the anæsthetic leg; and after this had been done seven times, the patient informed me she had been very much astonished by the period having returned. It came twice more, at a month's interval each time, after which I lost sight of the patient.

In *Displacements of the Womb*, such as anteversion and retroversion, Faradisation does a great deal of good by strengthening the muscular tone of the organ, and thus allowing it to return to its proper position.

The Electro-Chemical Bath.

In 1855, M. Poey stated in a paper which was read before the French Academy, that it is possible to extract various metallic substances from the human body by the aid of electricity; whether they have been taken as remedies, or have become absorbed into the system of persons occupied in the different arts and trades in which their employment is required. He relates that an electro-plater, at Havana, who had frequently immersed his hands into solutions of nitrate and cyanide of gold and silver, became affected with a bad ulcer which resisted every treatment. On one occasion, while preparing a bath for electro-plating, he immersed

his hands into the liquid before the object to be plated had been in it, and noticed that the negative wire became covered with a metallic coating. From this it was concluded that these deposits came from the hands of the electro-plater, who was advised by Mr. Poey to repeat the operation in order to extract any particles of metal which might be remaining. The result was that his hand was completely cured.

The "electro-chemical bath" consists of a large copper tub filled with water, and insulated from the ground; and the patient sits in the tub on a wooden seat which is likewise insulated. If mercury, silver, or gold is to be extracted, the water in the tub is acidulated with nitric or hydrochloric acid; if lead is to be extracted, sulphuric acid is added. One end of the tub is connected by means of a screw with the negative pole of a battery of thirty pairs; while the positive pole is held by the patient in the right and the left hand alternately. The positive electrode is made of iron, and covered with moistened linen. The galvanic current now enters the body by one of the arms; it circulates, according to M. Poey's graphic description, everywhere, from head to foot, traverses all the internal organs, and even the bones, seizes every particle of metal which it meets on its journey, restores it to its primitive form, and deposits it on the entire surface of the sides of the tub, more especially opposite that part of the body where the metal is supposed to exist. M. Poey describes the case of a patient who complained of pain in the arm in consequence of having taken mercury; the man was put into the bath, and the arm became delineated on the negative plate, by the deposit of the metallic molecules which came from the limb. He also states that he has drawn from the femur and the tibia of another patient a large quantity of mercury

which, according to some physicians, had existed in these bones for fifteen years.

Further reports on the efficacy of the electro-chemical baths have since then been brought forward, but in a singularly objectionable manner. The latest publication on this subject contains, amongst other things, a fac-simile of the medals which have been awarded to a zealous advocate of the bath! It would have been much more satisfactory if, instead of that, scientific proofs of the possibility of extracting metals from the body had been given. For us it is impossible to understand how the galvanic current can convey into the liquid of the bath, and diffuse on the whole surface of the sides of the tub, metallic atoms, which, according to the established laws of electro-chemistry, ought to be deposited only upon the surface of the electrodes. Again, in many cases patients are said to have been suffering from the effects of poisonous metals in the system, but no proofs of the actual presence of such metals in the body have ever been forthcoming. Let a patient be put into the bath where there is no doubt about the presence of a foreign metal in the system; as for instance, one who has become blue by the prolonged use of nitrate of silver; when such a patient has been rendered white by the bath, I shall be convinced, but not until then. The American patient, Eli B., who made a tour of the European hospitals ten years ago, and who was a sort of celebrity as the "blue man," had taken a large number of electro-chemical baths at New York, in order to get rid of the blue colour, but without the least effect; and this is, in my opinion, a strong case against the electro-chemical bath. I willingly admit that in some cases of rheumatism and allied affections, the electro-chemical bath may be of service, especially when combined, as is now often done, with a local application of the current to the suffering part; but there it does

not act by extracting metals ; nor can we doubt that in many cases the electro-chemical bath must be ineffective or hurtful, where a proper application of electricity to the suffering part alone might cure the patient.

Surgical applications of Electricity.

While for the medical application of electricity the use of sponge conductors moistened with warm water is generally the best, it is in surgical diseases found necessary to convey the galvanic current into the morbid tissues by means of gold or gilt steel needles. The skin should first be rendered insensible to pain, by means of ether spray, before the needles are introduced.

Tumours.

Four different methods of applying electricity have been recommended and used for the removal of tumours. These are, Faradisation by moistened conductors, the galvanic cautery, the external application of galvanic chains, and Electrolysis.

The Electrolytic treatment appears to be the most universally applicable method of electrification for the cure of tumours, although it is not so rapid as the galvanic cautery, especially where the tumours are large. Its effects are slow in all tumours except those with soft contents ; and it tends rather to a profound modification of the nutrition of the parts involved, than to a sudden destruction of the morbid growths. Electrolysis may therefore be described as a physiological, rather than a mechanical remedy. The kinds of tumour in which Electrolysis has hitherto proved chiefly successful are nævus, bronchocele, sebaceous tumours, hydatid tumours of the liver, and cancer.

Nævus.

Although nævus is not commonly dangerous to the patient affected with it, yet it entails a good deal of trouble and annoyance, and being most frequently seated on the scalp and face, gives rise to great disfigurement. Nævus is also liable to be inflamed by disease or injury, and ulceration may ensue, exposing part of its substance, and forming irritable and often bleeding sores, which rarely heal soundly. It is, therefore, always desirable to have a nævus removed.

The chief objections to the usual operations are that they are attended with considerable hæmorrhage, which is a serious matter in the case of young children; and they are often followed by tedious sloughing and suppuration, and even by phlebitis and pyæmia, with fatal results. Nothing of this kind is to be feared from the electrolytic treatment.

CASE L.—In July, 1866, Mr. White Cooper requested me to see with him a lady, aged 28, who had a congenital nævus of the right lower eyelid, of the size of a small pea, which it was thought desirable to remove. I expressed the opinion that this might be safely done by Electrolysis, without hæmorrhage, and without subsequent inflammation, suppuration, or sloughing; we therefore met on July 23rd, in order to perform the operation. As the patient was of a highly sensitive constitution, chloroform was administered by Dr. Allan, the ordinary medical attendant of the lady. As soon as she was fairly under the influence of it, Mr. White Cooper introduced a needle connected with the negative pole of ten cells of the battery into the right half of the tumour, and I closed the circuit by placing a moistened electrode connected with the positive pole to the skin of the neck. The current was then allowed to pass for two minutes, after which the needle was withdrawn. Not a drop of blood was lost during or after the operation. The patient recovered well from the chloroform, and said that she felt no pain in the part that had been operated upon, but merely a slight stiffness. The right half of the tumour appeared shrunk and shrivelled up, while the left half had not been altered in any way. This was an interesting circumstance, as it showed that even in so small a tumour as the one described, the action of the current could be exactly limited to that portion of it which was in contact with the

needle. We met again on July 26, when the same operation was performed on the other half of the tumour; but this time the patient objected to the use of chloroform, and bore the galvanism extremely well without it. I have not seen the patient since; but received, on October 13th, a note from Dr. Allan, in which he expressed himself as follows:—"Mrs. —— is in the country, but last time I heard from her she said that the nævus had disappeared. A dozen years ago I wished it to be removed, but no one would do it; and the able and esteemed oculist whom she then consulted deprecated all interference. At length I persuaded her to have another opinion (that of Mr. White Cooper). The result was your employment of galvanism, with the happy effect of complete obliteration of the evil."

CASE LI.—*Nævus of the Orbit; Electrolysis; Cure.*

A male child, aged 7 months, was sent to me by Dr. Schulhoff, in December, 1867, with a congenital nævus at the angle of the right eye, part of it being intra-orbital. It had the size of an almond, and was highly vascular. When the child was 5 weeks old, the tumour was on three different occasions cauterised with nitric acid. This (according to the parents) only took the colour out of it, but did not diminish the size of the tumour. At 2 months of age the child was vaccinated in the nævus, which for a time checked its growth; but it soon afterwards began to increase again. It was then twice more cauterised with nitric acid, but as this had no effect, Mr. Nunn, who was then consulted, advised the use of Electrolysis. After five applications the tumour seemed entirely destroyed, and a scab was formed, which came off within two weeks. The tumour had a considerable tendency to reproduce itself, and it was therefore again electrolysed from time to time. When I last saw the child (October, 1869), no trace of the tumour was left, but only a slight induration of the cellular tissue, for the removal of which I recommended the local application of the tincture of iodine.

All cases of nævus, wherever they may be seated, and whatever may be their size, are suitable for the electrolytic treatment; and even where they are so vascular as to make it appear that any interference with them must needs give rise to copious hæmorrhage, not a drop of blood is lost, if the operation is judiciously performed. I have operated on

babies only three months old, and who yet bore the galvanism perfectly well. On the whole, I recommend the operation as early as possible, as *nævi* often grow extremely fast, and if allowed to develop, require a much longer time for their cure than when they are treated at an early period of their existence.

Sebaceous Tumours.

As these tumours never attain to any considerable size, they may be rapidly removed, as shown by the following instance :—

CASE LII.—A young lady, of considerable personal attractions, was sent to me by Mr. White Cooper, in April 1867, for a sebaceous tumour which she had on the right side of the nose, near the eye, and which had existed for the last three years. The tumour did not give rise to any inconvenience, but spoilt her appearance, and she was therefore anxious to have it removed. A gentle current was used four times within ten days, after which the tumour had disappeared. I saw this lady again in October last, when not the slightest scar, or even redness of the skin, was perceptible on the place where the galvanism had been applied.

Warts, and Hypertrophy of the Skin generally.

CASE LIII.—A gentleman, aged 59, consulted me in April 1867, for two little tumours of this kind, which he had had on both eyelids for the last two years. They were not painful, but annoyed him by their presence, and he therefore wished to have them removed. The smaller one of the two was removed by the first application, the larger one required two such, after which it fell off.

CASE LIV.—A physician, aged 45, had a similar but larger growth on the nape of the neck, which he wished to get rid of. I applied the current to the base of the tumour on two several occasions, after which it came away.

CASE LV.—A lady, aged 38, had a hairy wart on the upper lip which was a great eyesore. Two electrolytic applications removed the growth completely, without leaving a scar.

Cysts.

CASE LVI.—A gentleman, aged 53, was sent to me by Dr. Giles, of Lewisham, in June, 1867. He had a cystic tumour on the lower lip which had grown there during the last two or three months. He was not aware of any cause which could have brought it on. The fluid escaped during the first application, and the cyst did not refill. The walls of the cyst required seven more applications, after which every trace of it had disappeared.

Ganglion.

CASE LVII.—A lady, aged 35, consulted me in March 1867, for a ganglion on the right wrist, over the extensor tendons of the fingers. It was as large as a filbert, and occasioned much weakness in the joint. After six applications it was entirely removed.

For *goître* (*bronchocele*, *Derbyshire neck*) the electrolytic treatment is also most valuable, because any other surgical interference with such tumours is so dangerous to life that few surgeons are willing to operate. In most of the cases which have been under my care, Mr. Prescott Hewitt, Mr. Paget, Sir William Fergusson, Mr. Cæsar Hawkins, and other eminent surgeons, had been previously consulted, and pronounced any of the ordinary operations to be inadmissible. All these tumours were solid, and of very large size, and on that account required a long continuance of the treatment; but I believe that all cases of bronchocele, however large, may be cured by electrolysis, if the treatment be persevered in for a sufficient time. The cystic variety is, of course, much more rapidly curable with it than the solid.

Dr. Morell Mackenzie, to whom we are indebted for so much additional knowledge in the pathology and treatment of diseases of the throat, has kindly given me, in the following lines, his experience with electrolysis in cases of *goître* :—

‘I have used electrolysis as recommended by Dr. Althaus in several cases of goître with a fair amount of success. In one instance in particular, the treatment was rapidly followed by most satisfactory results. The following are brief notes of the case.

‘Adelina G., aged 17, a native of Savoy, came under my care at the Hospital for Diseases of the Throat on June 14, 1867, on account of a goître which had been coming on for two years. The swelling affected both lobes; each of which appeared about as large as a moderate-sized orange. The hypertrophied tissue seemed to be of moderate density, uniformly distributed and not nodular. The neck measured eighteen inches round, when the tape was carried over the prominences of the thyroid gland.

Treatment by electrolysis was at once commenced, two needles being introduced into the enlarged lobes and kept in for about ten minutes. This operation was repeated on the 16th, and again on the 19th, on which day there did not appear to be any change in the form or size of the thyroid glands. On the 22nd the patient was seen again, and as she stated that she was sure that the throat was much smaller, it was measured again and found to be reduced to seventeen inches. The reduction had principally taken place in the right lobe. A week later the left side was much smaller, the throat only measuring sixteen and a quarter inches. On July 5 it was reduced to fifteen and a half inches, and on July 11 it measured only fifteen inches. As there was now no apparent enlargement, the treatment, which had been carried out for less than one month, was discontinued. The patient had been previously treated by an English practitioner who had given her medicine and tincture of iodine to apply externally. Neither had done her any good, and when she came to the Hospital, treatment had been altogether suspended for three months. During the time that the electrolytic treatment was being carried out, no other remedies either external or internal were employed.

So remarkably successful was the treatment, that an Italian gentleman well acquainted with the case called at the Hospital some months afterwards, in order to procure a battery of the same kind for use in the village in Savoy, whence Adelina G. had come. Although he informed me that there were many other similar cases in the same village, I did not recommend him to use electrolysis, except under the direction of a medical practitioner.

In several other cases under my care, benefit resulted from elec-

trolysis. In one very dense hypertrophy, the results were negative. I consider that electrolysis is very useful in cases of moderate duration—six months to two years—and of yielding consistence.

I will only add to this statement, that in the solid variety a more powerful current is required than in the cystic (*viz.*, from thirty to forty cells instead of ten or fifteen).

Cancer.

In my paper on the electrolytic treatment of tumours and other surgical diseases (1867), I expressed myself as follows concerning the value of electrolysis in cancer:—“A larger experience than I command at present is necessary to decide the question, whether the electrolytic treatment will eventually supersede the methods now in use for the removal of cancer Electrolysis, however, may be applied to every variety of cancer, and it seems to be of little consequence whether or not the tumour adheres to the bones; a circumstance which often renders removal by the knife difficult or impossible. I believe that in this disease the electrolytic method will be found generally useful, not merely by removing the present tumours, but also by so modifying the nutrition of the parts concerned, that no relapse is likely to take place there; and it may thus indirectly help towards the eradication of the cancerous diathesis. It is a curious fact that the peculiar lancinating pains of cancer generally seem to disappear, or at least to diminish considerably, soon after the commencement of the electrolytic treatment, and long before the whole tumour has disappeared.”

I have successfully electrolysed several cases of cancer; but as I do not wish to relate any cases in this section which have not been seen by at least two medical practitioners, I prefer to give the details of a bad case of cancer which has been recently put on record by Dr. Neftel,* of New York.

* Virchow's Archiv, November 1869, p. 521.

Dr. Neftel used in his case the "serres-fines conductor," first described in my paper on the treatment of tumours by electrolysis, which appeared in the "Medical Times and Gazette" for May 2, 1868.

The patient was a member of the American Congress, and aged 56. In 1868 he consulted a number of eminent surgeons, both in London and Paris, who were unanimous in their opinions concerning the cancerous nature of the tumour, which occupied the left mammillary region. They all refused to operate, as the case was even then looked upon as one of general infection of the system with the cancerous poison, and it was therefore thought that a surgical operation would only accelerate the inevitably fatal result. The tumour was however eventually excised by Dr. Marion Sims, in Paris. Soon after the wound had healed, the axillary glands of the left side began to enlarge, and formed in January, 1869, a hard swelling of the size of a fist. The patient and Dr. Marion Sims were both at that time in New York, and the same surgeon again excised the tumour, which was exhibited at a meeting of the Pathological Society of New York, and microscopically examined by competent histologists, who pronounced it to be cancerous. Diffuse erysipelas set in after the second operation, with fever and severe constitutional disturbance, the temperature rose to 106° , and there were rigors and delirium. The patient rallied after a time, but the wounds afterwards healed very slowly. Cicatrisation was hardly completed when a fresh tumour began to develop itself in the right mammillary region. This grew rapidly, and soon attained the size of an orange.

Further surgical procedures now appeared inadmissible, especially as the general health of the patient had given way. Dr. Neftel therefore proposed to employ the electrolytic treatment. He introduced on three several occasions, in April and May, 1869, at first two, then three, and at last four gilt needles separately into the tumour, and connected them, by means of the serres-fines conductor, with the negative pole of a Daniell's battery, the positive electrode being placed on the skin in the neighbourhood of the tumour. He began with a current of ten cells, which was gradually increased to thirty. The first operation lasted two, the second five, and the third ten minutes. The needles were removed without any hæmorrhage taking place. Immediately after the operation the tumour appeared considerably larger, from the hydrogen which had become evolved in it, but it was softer and more elastic to the touch. No fever or any other unpleasant symptoms supervened; on the contrary, the patient, who had been

very feeble, anæmic and cachectic, became stronger from day to day, and the tumour gradually began to shrink. Two months after the first application, it had almost entirely disappeared; and three months after, no trace of it was left. The general health of the patient had improved *pari passu*, and was, when last seen, excellent. No fresh tumour had appeared anywhere.

Dr. Neftel is inclined to believe that electrolysis produces remote constitutional effects, by altering the condition of the protoplasm of the cells in which the poison of the cancer is contained, and by the propagation of which the disease becomes constitutional. As soon as the protoplasm has, by the electrolytic process, lost its specific contagious qualities, the cancer is prevented from reproducing itself, and gradually disappears through the process of absorption.

Lipoma.

Fat being a very imperfect conductor of electricity, lipomas offer more resistance to the electrolytic treatment than other tumours. They may, however, be completely removed by it in course of time. Free alkali being, by the action of the negative pole, developed from the blood-vessels and the connective tissues in which the fat is embedded, the tumour is gradually changed into an emulsion, which is absorbed into the general circulation.

In leaving this subject, I must lay stress on the importance of having a perfectly satisfactory action of the battery, as insufficient galvanic power has in such operations, to my knowledge, been a cause of disappointment. As regards the number of cells to be employed, we must be guided by the nature of the tumour. For cysts and tumours with soft contents, less power is required than for hard swellings. *Solid bronchoceles and scirrhous will resist ten or fifteen cells, but yield to thirty or forty.*

Wounds and Ulcers.

In *wounds* and *ulcers* which are slow to heal, and where the secretion is of an unsatisfactory character, the application of the negative pole is usually followed by excellent

results. I have in several instances seen a rapid improvement in the aspect, and a kind healing of ulcers, which had existed for a long time, and where gangrene had already supervened, follow a few applications of the current. An additional advantage in such cases is, that scars, which are developed under the influence of the negative pole, have little or no tendency to contract, and in course of time merge into healthy skin, so as to leave no trace of the original injury.

18, BRYANSTON STREET, PORTMAN SQUARE,
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